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MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEATS, 1944 CROP^{1/}

by

C. C. Fifield, Baking Technologist, and J. A. Clark, Senior Agronomist, Wheat Investigations, Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering; Ray Weaver and J. F. Hayes, Assistant Grain Technologists; and E. Hoffecker, T. F. Hartsing, B. E. Rothgeb, Associate Grain Technologists, Grain Branch, Production and Marketing Administration

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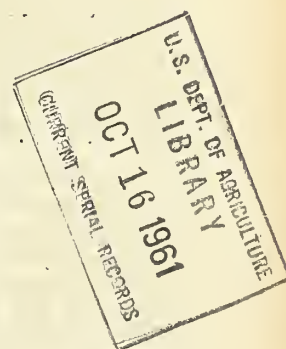
INTRODUCTION

Samples of some of the standard varieties and new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region^{2/} of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread to determine their quality characteristics.

1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, and the Grain Branch Production and Marketing Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring-wheat region.

2/ Clark, J. A. Results of spring-wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1944, with averages for 1929 to 1944. U.S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils and Agr. Engin., Div. Cereal Crops and Dis. [mimeographed] 17 CC 51 pp. January, 1945.

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One of the regular baking methods (no. 6) used for the 1939, 1940, 1941, 1942, and 1943 crops was continued for all of the 1944 experiments and in addition the bromate response methods, as used in the 1941, 1942 and 1943 reports on a selected group of hard red spring and hard red winter wheats comparatively grown at Sheridan, Wyo. These bromate response tests replaced the No. 2 and No. 3 methods formerly used. These older methods and also the Minnesota and North Dakota laboratory methods were used only on the seven uniform varieties of both the Eastern and Western composites from the region.

In addition, commercial wheat samples from cars grading No. 3 or better were obtained from terminal markets by the Grain Branch, Production and Marketing Administration for comparison with varietal samples grown in plot and nursery experiments at agricultural experiment stations.

The purpose of this report is to make available to cooperators the quality data from the 1944 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

SOURCE OF SAMPLES

The most extensive tests (10) were made on Eastern and Western composite samples of each of seven uniform varieties grown in plots at cooperating stations. The regular No. 6 and bromate response tests were made on variety samples from plots grown at Madison, Wis., St. Paul, Morris, and Waseca, Minn., Fargo, Langdon, Williston, Dickinson, and Edgemoor, N. Dak., Moccasin and Havre, Mont., Akron, Colo., and Sheridan, Wyo. Similar tests were made on samples of new wheats grown in single increase plots (1943-1944 Arizona increases) grown at Langdon, Mandan and Dickinson, N. Dak. Similar tests were also made on Eastern and Western composites of the 26 strains grown in Uniform Regional Nurseries, composite samples from N. Dak. and Montana Intra-State Nurseries, and from Langdon and Dickinson, N. Dak., and Bozeman, Mont., station nurseries.

There were also included ten samples composited from samplings of carlot receipts of wheat accumulated during a 90-day period of the 1944 crop movement by the Minneapolis, Great Falls, and Spokane office of the Grain Branch, Production and Marketing Administration. These samples represent country-run wheat of the hard red spring class and were graded under the provisions of the U. S. Grain Standards Act as No. 3 or better. These samples are hereafter referred to as commercial samples. This is the sixth season that such samples have been collected and tested.

All 1944 samples were of a lower protein level than in recent years and the tendency to sprout of some varieties, particularly Rival, seems to have given a decided advantage not revealed in dryer seasons.

METHODS USED IN THE MILLING AND BAKING TESTS

The samples were cleaned for milling by the means of a small milling separator, (equipped with sieves and air blast) and a scouring machine. The wheats were tempered in two stages; first to 14 percent for 48 hours and then additional amounts of water added 1 1/2 hour previous to milling raising the moisture content of the grain between 15.0 and 16.5 percent depending upon the hardness of the variety. The hardness of the variety was determined by the means of a Strong-Scott barley picker. The wheat was milled on an Allis-Chalmers experimental flour mill provided with three break rolls and one smooth roll. A 90 percent flour was made discarding the low grade. In previous years, a longer extraction flour has been used.

Baking tests on all of the 1944 varietal samples were conducted by the straight dough procedure using the commercial-bromate-malted wheat flour formula (no. 6) supplemented by the amount of potassium bromate which was varied to produce an optimum or maximum loaf volume.

The No. 6 baking test (including .001 percent, or 1 milligram of bromate per 100 gr's of flour) was used for the 1939, 1940, 1941, 1942, and 1943 samples and is sometimes referred to as the rich dough method.

This baking procedure was based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached experimentally milled flour. Because of the size of the mixing bowl, ingredients sufficient for two loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swanson dough-mixer (108 R. P. M.) with 4 pins in the head and 2 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated

in the tables. When mixed, the doughs were divided, then rounded in the hands and placed in fermentation granite-ware "oatmeal" bowls, measuring 6 inches top diameter, 3 inches bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of an inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. A proofing time of 55 minutes at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked but since the ingredients were mixed as for one loaf, the two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking method (No. 1) which had been used on all samples starting with the 1929 crop was discontinued in 1942, as it produced much lower volumes than the other baking methods used on the 1942 and the previous crops. The commercial method (No. 2) was added in 1935 and in 1936 the commercial-bromate (No. 3). For a part of the samples in 1937, the basic, commercial and commercial-bromate bakes were made. In 1938 the same bakes as reported in 1937 were made and in addition the (No. 4) malt-phosphate-bromate. In 1939, the No. 4 method, which had been found to be unsatisfactory under our condition, was replaced by the commercial-bromate-malted wheat flour (No. 6) test. The commercial-bromate-malted wheat flour (No. 6) test was first used for part of the 1938 samples and has been continued for all of the 1939, 1940, 1941, 1942, 1943, and 1944 samples. The No. 2 and No. 3 methods were discontinued in 1944 for most tests because they gave poorer volumes than the No. 6 method.

In 1944 additional baking tests were made by varying the amounts of bromate (0 to 4 mg. per 100 grams of flour) with the commercial bromate-malted-wheat flour (No. 6) formula. With this baking procedure the optimum or maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the optimum volume also has the best crumb color and grain-texture of the different baking tests made. This supplemented No. 6 test appears to bring out the full strength of the wheats somewhat better than the methods previously used. In actual practice a baking test with 1 milligram (No. 6) and 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (.003 grams or higher) are made of the following days until the optimum loaf volume has been reached for each variety or strain. Average volumes are calculated from the three best bakes, only. This baking procedure brings each of the samples to its optimum volume by making provision for adequate gas production by the employment of sufficient sugar and disstatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate.

The only special tests made in 1944 were on the Eastern and Western composites for the seven uniform varieties by the older U.S.D.A., the Minnesota and North Dakota laboratory methods, and the bromate response tests first started on spring and winter samples from Sheridan, Wyo. The latter were made from peck grain samples milled on the Buhler mill. The results can be compared with Allis milled grain from the same station.

Details of the methods used in 1944, with the various ingredients are shown in Table 1.

Table 1.- Baking methods used for samples of the 1944 crop

Ingredients	Baking method	
	Commercial-bromate-malted	
	wheat flour	
Flour (grams)	100.0	
Yeast (grams)	2.0	
Salt (grams)	1.5	
Sugar (grams)	5.0	
Potassium bromate (grams) 1/	.0 to .004	
Malted wheat flour (grams)	.25	
Nonfat dry milk solids (grams)	4.0	
Shortening (grams)	3.0	
Water absorption (percent)	Optimum	
Mixing time (minutes)	Optimum for	each variety
Fermentation time (minutes)	180	

1/ 0, 1, 2, 3 and 4 mg.

Fermentation periods:

1st. punch after 105 minutes, and
2nd. punch after additional 50 minutes.
Mold after additional 25 minutes.
Proofing time - 55 minutes.
Baked 25 minutes at 450° F.

A check flour for control purposes was included in the baking trials with each days tests. The loaf volume for each bake with the standard flour (15.1 pct. protein) and the date of the baking test are shown in the following tabulation.

Date	Volume (Cc.)	Date	Volume (Cc.)	Date	Volume (Cc.)
Nov. 28	800	Feb. 5	809	Apr. 4	842
29	803	6	815	5	804
Dec. 13	809	7	809	8	842
14	795	8	816	9	812
19	800	9	809	10	821
20	812	12	806	15	846
21	806	Mar. 3	818	16	827
22	798	4	815	18	836
26	812	5	800	21	870
28	824	6	810	22	861
29	801	9	801	23	815
Jan. 2	809	10	798	25	818
3	789	13	795	28	800
4	812	16	792	29	842
5	798	17	812	31	839
8	812	18	807	May 5	798
9	789	19	804	7	806
12	798	20	804	8	808
24	796	24	812	Total 64	8183
25	781	26	821	Average	810
29	792	27	821	Standard Error	14.4
Feb. 1	801	30	818		
2	830	Apr. 3	788		

Sixty-four baking tests were made with the standard flour. The average loaf volume is 810 cc and the standard error 14.4. On this basis the least significant difference between 2 single bakes is 41 cc.

EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 7, for bromate response on Sheridan, Wyo., spring and winter varieties in table 8, for U.S.D.A., North Dakota, and Minnesota methods on seven uniform varieties in table 9. The results for the commercial samples are shown in table 10, and the correlation and regression coefficients for 14 varieties and strains are shown in table 11. Summaries of the comparable 1944 samples are averaged in table 12 and the 6-year results in table 13. These tables are largely self-explanatory. The highest ranking variety or strain with respect to each property is indicated by underlining.

Acres yields are included, where comparable, to assist in the interpretation of results. The test weights for most of the composite and station samples were satisfactory. The milling and chemical data in table 2 are not repeated for the other baking methods reported in table 9.

All test weights were determined in the laboratory on a dockage-free basis. The protein and ash contents are reported on a 14.0 percent moisture basis and the flour yield on a moisture-free basis.

Plot Samples

Table 2.--Yield, milling, bolting, and chemical results on the uniform varieties of hard red spring wheat grown at experiment stations, from the Eastern and Western composites of the 1944 crop

Section and Variety	State or Nursery number	C. I. number	Acro yield Bu.	Test weight Lbs.	Protein		Flour		Ab- sorb- ing time	Baking Methods and Loaf Volume										Average			
					Wheat		Yield			Ash		Milligrams of Bromate										Crumb, Color, texture	Score
					Pct.	Pct.	Pct.	Pct.		Pct.	Pct.	0	1	2	3	4	Aver.	Opt- imum	Wt. of Loaf				
					Pct.	Pct.	Pct.	Pct.		Pct.	Pct.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Grams			
Eastern Composite ^{1/}																							
Cadet	1597	12053	25.3	8.8	13.1	12.5	74.3	.56	70	2.5	738	854	917	859	877	917	153	94	91				
Regent	PL 9756	12070	26.0	58.5	13.6	13.1	73.6	.57	64	2.0	674	824	871	903	874	903	148	85	85				
Newhatch	Ms. 2752	12318	27.4	58.6	13.6	13.1	75.2	.58	69	2.5	806	876	898	888	881	898	151	89	90				
Rival	Ms. 2634	11708	26.8	59.9	13.0	12.1	75.3	.61	67	2.5	795	873	851	827	850	873	150	93	90				
Thatcher	Ms. 2903	10003	25.5	59.0	13.1	12.4	74.4	.56	67	2.5	755	847	868	839	851	868	151	86	88				
Pilot	1098-13	11945	27.8	59.0	12.5	11.4	73.1	.47	64	2.0	800	845	824	798	823	845	148	93	90				
Midra	Ms. 2829	12008	28.6	60.6	13.1	12.2	75.4	.55	65	2.0	744	830	815	798	814	830	150	93	90				
Average Range																							
			26.8	59.1	13.1	12.1	74.5	.56	67	2.5	759	850	863	842	853	876	150	91	89				
			3.1	2.1	1.1	1.7	2.3	.14	6		132	52	102	105	67	87	5	13	6				
Western Composite ^{2/}																							
Newhatch		12318	27.2	58.6	14.5	14.3	76.3	.55	66	2.0	865	913	928	924	902	928	150	88	89	1	5		
Thatcher		10003	28.1	59.2	14.1	13.5	72.8	.50	69	2.0	886	911	885	806	894	911	151	89	85				
Marquis		33641	21.2	59.2	13.4	12.9	71.5	.51	65	2.0	804	842	897	826	855	897	149	88	90				
Cadet		12053	28.0	58.7	14.0	13.9	72.8	.52	69	2.0	821	894	890	850	878	894	152	93	94				
Pilot		11945	29.0	58.9	13.5	12.6	72.7	.47	64	2.0	853	888	865	798	869	888	149	89	89				
Ceres		6900	28.1	60.0	13.6	13.0	72.9	.48	67	2.0	848	850	848	766	849	850	151	90	88				
Midra		12008	26.9	61.3	13.6	13.0	74.2	.47	63	2.0	818	845	833	795	832	845	150	94	91				
Average Range																							
			27.4	58.4	13.8	13.3	73.3	.50	66	2.0	842	878	878	809	868	888	150	90	89				
			4.8	2.7	1.1	1.7	4.8	.08	5		82	71	95	84	70	83	4	6	9				
Average of Eastern and Western Composites																							
Newhatch		12318	27.3	58.6	14.1	13.7	75.8	.57	63	2.3	836	895	913	846	885	913	151	89	90				
Cadet		12053	26.8	58.8	13.6	13.2	73.6	.54	70	2.3	780	874	901	855	878	904	153	94	93				
Thatcher		10003	26.3	59.1	13.5	13.0	73.6	.53	68	2.3	821	879	879	823	860	879	151	88	87				
Pilot		11945	28.4	59.0	13.0	12.0	72.9	.47	64	2.0	827	867	845	798	846	867	149	91	90				
Midra		12008	27.8	61.0	13.4	12.6	74.8	.51	65	2.0	781	838	824	797	820	838	150	96	91				
Average Range																							
			27.4	59.3	13.5	12.9	74.1	.52	67	2.2	809	871	873	824	858	880	151	92	90				
			1.6	2.4	1.1	1.7	2.9	.10	6	.3	56	57	89	558	65	75	4	8	6				

1/ From the Madison, St. Paul, Waseca, Morris, Langdon, Fargo and Edgeley stations.

2/ From the Dickinson, Williston, Havre, Moccasin, and Sheridan stations.

Table 2--Continued

Variety	Acre Yield		Test weight lbs.	Protein		Flour		Baking methods			Average			
	Region	Compo- site		Theat	Flour	Yield	Ash	No. 6	Aver.	Cc.	Opt.	Cc.	Crumb color	Grain texture
Average 7 years 1938 to 1944, inclusive														
Pilot	26.0	26.2	57.5	15.2	14.3	69.4	.54	930	898	932	149	87	88	
Thatcher	24.3	24.7	57.4	15.2	14.7	69.7	.56	929	884	929	150	85	85	
Ceres ^{3/}	22.4	22.4	58.1	15.1	14.6	69.1	.54	905	870	908	150	86	86	
Rival ^{4/}	24.5	25.2	58.3	15.1	14.2	72.1	.58	903	855	903	150	89	88	
Marquis ^{3/}	19.2	19.5	56.4	14.8	14.1	67.6	.58	888	852	902	149	86	87	
Average	23.3	23.6	57.5	15.1	14.4	69.6	.56	911	872	915	150	87	87	
Range	6.8	6.7	1.9	.4	.6	4.5	.04	42	46	30	1	4	3	
Average 3 years 1942 to 1944, inclusive														
Newthatch ^{5/}	26.6	30.3	57.6	15.1	14.3	70.6	.56	928	890	935	150	89	88	
Cadet	26.1	26.6	57.7	14.9	14.3	71.1	.56	893	827	903	153	89	87	
Regent ^{4/}	23.9	25.6	58.3	14.9	14.3	72.1	.54	876	840	902	149	85	84	
Pilot	28.2	28.4	58.3	14.3	13.4	69.3	.51	899	866	899	149	91	89	
Thatcher ^{3/}	23.3	20.8	58.1	14.4	13.9	69.4	.56	895	850	895	150	88	86	
Marquis ^{3/}	25.6	26.6	58.6	14.4	13.5	67.8	.52	875	835	894	148	91	90	
Rival ^{4/}	26.9	24.5	59.0	14.4	13.5	73.1	.59	890	835	890	151	93	88	
Ceres ^{3/}			59.5	14.8	14.1	69.1	.51	886	844	886	150	91	88	
Average	25.8	26.1	58.4	14.7	14.7	70.3	.54	893	848	901	150	90	88	
Range	5.4	9.5	1.9	.8	.9	5.3	.08	53	55	49	5	8	6	
^{3/} Results for the Western composite only for 1942 to 1944, inclusive.														
^{4/} Results for the Eastern composite only for 1944.														
^{5/} Results for the Eastern composite only for 1942 and 1943.														

Table 3.--Yield, milling, boling and chemical results for the lording hard red spring wheats grown in replicated "plots" at 13 experiment stations in 1944.

Madison, Wis.

Variety or Cross	State or N. No.	C. I. number	Acre yield bu.	Test weight lbs.	Protein		Flour Yield Pct.	Ash Pct.	Ab- sorp- tion Pct.	Mix- ing time min.	Baking Methods and Leaf Volume							Average		
					Wheat Pct.	Flour Pct.					Milligrams of Bromate					Aver. 3 best Cc.	Opt- imum Cc.			Wt. of Leaf Grams
											0	1	2	3	4					
Regent	RL975.6	12070	25.1	58.7	13.2	12.5	73.5	.58	35	2.0	833	850	824		836	148	90	90		
Cadet	1597	12053	28.4	58.4	12.0	11.3	74.6	.57	67	2.0	738	747	778	729	754	153	90	93		
Merit x Pilot	1764	12315	29.5	59.3	12.4	11.6	73.5	.55	68	2.0	766	772	749		762	154	90	88		
Sturgeon		11703	23.0	60.0	12.3	11.0	71.8	.45	34	2.0	747	772	726		748	150	93	90		
Henry	Wis233	12265	27.8	59.7	11.2	10.1	75.6	.49	64	2.0	729	769	738		745	151	78	88		
Thatcher		10003	27.1	58.8	12.5	11.7	72.9	.55	64	2.0	744	755	740		746	148	90	92		
Mida	Ms.2829	12008	28.8	60.7	12.4	11.7	73.9	.52	65	2.0	723	747	747		739	153	90	87		
Rival		11708	26.7	60.5	11.6	10.8	75.4	.58	65	2.0	699	738	723		720	152	87	88		
Newhatch	Min.2752	12318	28.5	59.5	12.2	11.5	74.4	.56	64	2.0	712	729	715		719	150	90	90		
Pilot	1098-13	11945	28.5	59.6	11.4	10.4	72.6	.47	64	2.0	707	720	729	626	718	149	93	92		
H-157A-1-5-1-3		12425	26.1	58.8	11.6	10.3	73.7	.50	64	2.0	645	686	615		649	150	70	82		
Pilot x Mida	1750	12316	31.8	62.6	12.2	11.3	74.9	.56	65	2.0	652	671	672		665	153	90	85		
Average			27.6	59.8	12.1	11.2	73.9	.53	65	2.0	733	744			733	151	88	89		
Range			8.8	3.9	2.0	2.4	3.8	.13	4	-	126	78			187	6	23	11		

St. Paul, Minn.

Regent	IL9756	12070	24.1	58.2	11.6	11.1	72.8	.55	62	2.0	732	755	707		731	150	90	90
Cadet	1597	12053	24.0	59.4	11.2	10.2	72.8	.55	68	2.0	726	750	726		734	153	97	92
Newhatch	Min2752	12318	26.2	59.4	11.6	11.0	74.5	.56	67	2.0	723	747	660		710	151	88	92
M. x Thatcher	Min2756	12357	27.6	60.4	10.7	9.9	75.0	.52	66	2.0	707	738	715		720	153	92	88
Thatcher		10003	24.4	59.0	11.4	10.6	73.4	.58	63	2.0	695	729	621		682	148	85	85
Rival		11708	25.5	59.4	10.6	9.8	74.2	.53	63	2.0	683	707	626		672	152	92	88
Henry	Wis233	12365	24.2	59.1	9.9	9.0	75.2	.46	60	2.0	655	704	680		680	151	77	85
M. x Thatcher	Min2755	12306	25.9	57.3	10.4	9.5	76.4	.51	64	2.0	660	680	674		671	151	90	87
Merit x Pilot	1764	12315	24.6	59.0	10.5	9.5	70.9	.49	65	2.0	680	671	655		669	153	90	90
H-44-M. x Thatcher	Min2754	12309	16.9	60.4	10.1	9.3	73.5	.47	62	2.0	657	677	662		665	150	93	87
Mida	Ms2829	12008	27.2	61.3	11.1	10.3	74.6	.47	62	2.0	629	677	651		652	151	93	88
Pilot	1098-13	11945	26.0	60.3	10.1	8.8	71.9	.46	61	2.0	646	669	567		627	150	90	87
M. x Thatcher	Min2757	12426	28.1	59.2	10.2	9.4	74.5	.50	64	2.0	646	634	634		638	151	88	90
Average			25.0	59.4	10.7	9.9	73.8	.51	63	2.0	689	696			681	151	90	88
Range			11.2	4.0	1.7	2.3	4.3	.12	8	2.0	98	121			107	5	12	7

Table 3--Continued

Waseca, Minn.

Variety or Cross	State or N. No.	C. I. number	Acro yield	Test weight	Protein		Flour		Ab- sorb- ing time	Baking Methods and Loaf Volume							Average	
					Wheat Flour		Yield	Ash		Milligrams of Bromate							Weight of Loaf Grams	Crumb Color
					Pct.	Pct.				0	1	2	3	4	Aver. 3 best	Opt- imum		
			Bu.	Lbs.						Min.	Co.	Co.	Co.	Co.	Co.	Co.		
Cadet	1597	12053	19.6	55.9	15.0	14.6	71.4	.62	68	2.0	905	974	986	998	986	998	151	93
Newthatch	Min2752	12318	19.5	53.2	15.6	15.1	73.8	.56	62	2.0	945	974	948		953	974	146	88
Pilot	1098-13	11945	20.3	56.9	14.4	13.2	71.4	.49	62	2.0	934	962	915		937	962	146	92
Thatcher		10003	14.5	55.7	14.6	14.0	72.6	.53	64	2.0	885	950	951	931	944	951	146	87
Regent	RL 975.6	12070	21.0	55.3	15.3	14.9	71.8	.56	62	2.0	888	928	940	951	941	951	147	90
MxThatcher	Min2755	12306	14.7	53.7	14.4	14.1	73.3	.60	67	2.0	836	928	951	934	938	951	150	83
Merit x Pilot	1764	12315	19.5	55.7	14.9	14.4	70.7	.52	69	2.0	836	891	948	908	916	948	152	90
MxThatcher	Min2757	12426	21.2	54.6	14.4	13.7	71.9	.51	68	2.0	894	928	931	878	913	931	151	90
MxThatcher	Min2756	12357	20.0	56.0	14.2	13.7	73.8	.52	67	2.0	868	928	911		902	928	149	90
Mida	Ns2829	12008	18.4	53.3	14.5	14.2	73.9	.54	64	2.0	856	917	862		878	917	148	92
Rival	Ns2634	11708	17.7	56.8	14.4	13.9	73.9	.56	65	2.0	859	889	913	868	890	913	148	93
Henry	Wis 233	12265	17.4	56.6	14.2	13.1	74.1	.53	62	2.0	830	905	868		868	905	148	82

Average Range

18.7 55.9 14.7 14.1 72.7 .55 65 2.0 878 931 927 922 944 93 149 89 91
 6.7 4.6 1.4 2.0 3.4 .13 7 - 115 85 124 118 93 6 11 10

Morris, Minn.

Cadet	1597	12053	29.4	59.7	13.4	13.1	73.3	.54	68	2.0	871	917	925	865	904	925	150	95	87
Newthatch	Min2752	12313	32.3	53.9	13.8	13.3	76.1	.52	66	2.0	783	905	893		860	905	149	85	85
H-44xThatcher	Min2754	12309	34.5	60.2	13.0	12.2	75.1	.48	66	2.0	850	901	856		869	901	149	90	87
Rival	Ns2634	11708	32.0	60.2	13.3	12.7	75.3	.56	67	2.0	868	896	848		871	896	150	93	85
Regent	FL9756	12070	31.1	58.0	13.6	13.4	74.9	.46	65	2.0	850	872	888	845	870	888	147	90	90
MxThatcher	Min2756	12357	34.7	53.9	12.9	12.1	76.3	.55	63	2.0	842	874	827		848	874	150	90	87
MeritxPilot	1764	12315	34.6	60.0	13.4	12.6	72.3	.51	69	2.0	839	868	842		850	868	151	93	88
Thatcher		10003	30.6	59.8	13.2	12.5	74.9	.54	65	2.0	830	865	827		841	865	147	92	88
Henry	Wis 233	12265	34.5	60.3	12.9	11.9	76.7	.47	62	1.5	842	859	854		852	859	147	80	35
MxThatcher	Min2775	12306	31.5	58.7	12.6	12.0	78.1	.54	63	2.0	836	847	818		834	847	152	90	88
Mida	Ns2829	12008	35.1	61.1	13.6	12.8	75.2	.51	64	2.0	758	824	806		796	824	150	92	85
Pilot	1098-13	11945	32.7	60.2	12.3	11.5	73.8	.50	62	2.0	786	821	750		786	821	146	88	82
MxThatcher	Min2757	12426	35.0	59.0	12.6	11.7	77.2	.53	66	2.0	792	801	755		783	801	149	88	88

Average Range

33.0 59.7 13.1 12.4 75.3 .52 66 2.9 843 861 843 867 121 124 149 90 87
 6.4 3.1 1.5 1.9 5.8 .09 7 .5 113 116 121 124 6 15 8

Table 3--Continued

Fargo, N. Dak.

Variety or Cross	State or N. No.	C. I. number	Acre yield	Test weight	Protein		Flour		Absorb- ing time	Baking Methods and Loaf Volume					Wt. of Loaf Grams	Crumb Color Score	Grain Texture Score	Average
					Wheat Flour		Yield	Ash		Milligrams of Bromate								
					Pct.	Pct.				0	1	2	3	4				
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Cc.	Cc.				
Cadet	1597	12053	16.6	57.7	12.8	12.0	70.0	.54	2.0	758	809	767		778	809	148	90	
Regent	RI. 9756	12070	19.5	59.3	12.2	11.7	71.1	.68	2.0	726	732	781	766	760	781	150	82	
Ceres x H.T.F.	1552	12077	22.1	58.7	11.6	10.4	70.2	.61	2.0	744	767	755		755	767	150	80	
Ms.2809-2822xPremier	Ms3095	12359	23.0	59.6	12.5	11.8	71.2	.71	2.0	715	740	767	707	741	767	150	82	
Newthatch	N. 2752	12318	22.9	58.8	12.4	11.9	74.2	.61	2.0	744	768	717		742	766	149	85	
C.DCx Mercury	Ms3103	12312	20.7	56.7	11.8	11.1	71.9	.61	2.0	738	758	732		743	758	145	80	
Marquis	3641	15.7	56.3	56.3	10.9	9.9	69.0	.51	.57	1.5	758	720	683	720	758	148	80	
Pilot	1098-13	11945	20.9	58.9	11.2	10.1	71.3	.55	2.0	744	747	726		739	747	149	82	
Renown		11947	21.2	60.7	11.8	10.8	72.3	.51	2.0	526	744	726		699	744	151	80	
Rival		11708	20.9	59.6	11.8	10.7	75.0	.61	2.0	741	729	701		724	741	147	80	
Ceresx H.T.F.	1556	12263	25.6	58.6	11.6	10.7	71.2	.54	2.0	706	741	709		719	741	146	82	
Ms.2809x2822	Ms3096	12360	21.1	58.4	12.2	11.5	73.3	.57	2.0	686	715	689		697	715	151	85	
C.DCx Mercury	Ms3122	12314	20.5	57.5	11.6	10.7	72.5	.60	2.0	689	709	690		693	709	148	77	
Pilotx Mida	1756	12303	23.5	60.5	11.1	10.2	71.8	.57	2.0	677	695	690		687	695	148	80	
Ms.2855	Ms2855	12335	22.6	60.5	11.2	10.1	73.0	.60	2.0	637	680	652		656	680	148	83	
C.DCx Mercury	Ms2829	12008	23.1	60.7	11.3	10.4	73.8	.56	2.0	674	677	674		675	677	149	82	
Mida		12316	20.7	58.2	12.0	10.9	71.2	.55	2.0	623	663	634		640	663	148	80	
Pilotx Mida	1750																	
Average			21.1	59.1	11.8	10.9	71.9	.59	2.0	721	712			716	735	149	82	
Range			7.9	4.9	1.8	2.1	6.0	.20	.5	95	175			138	146	6	13	

Edgeley, N. Dak.

Rival	11708	29.1	58.9	14.3	13.4	74.5	.52	2.0	919	1012	962			964	1012	150	93	
Merit x Pilot	12315	27.5	59.0	15.0	14.1	71.6	.53	2.0	980	986	998	971		988	998	151	90	
Regent	12070	26.9	59.6	14.6	14.3	73.8	.48	2.0	890	965	965	954		961	965	151	88	
C.DCx Mercury	12312	31.1	59.0	14.2	13.5	73.4	.44	2.0	914	951	919			928	951	150	95	
Newthatch	12318	30.1	58.3	14.5	14.1	74.7	.53	2.0	885	931	925			914	931	151	90	
Renown	11947	28.7	50.7	14.1	13.2	73.8	.49	2.0	824	928	888			880	928	149	90	
Cadet	12053	28.1	59.2	14.2	13.7	72.9	.48	2.0	902	925	913			913	925	153	87	
C.DCx Mercury	12300	35.2	58.8	13.6	12.5	75.6	.47	2.0	876	889	876			880	889	150	92	
Pilot	11945	32.5	59.5	13.8	12.4	71.7	.46	2.0	874	858	848			860	874	150	88	
Mida	12008	31.8	60.3	13.7	12.9	75.0	.47	2.0	867	871	845			862	871	153	85	
Thatcher	10003	29.7	59.6	13.3	12.6	73.5	.54	2.0	798	859	764			897	859	151	92	
Average		29.7	59.4	14.1	13.3	73.7	.49	2.0	896	919				905	928	151	90	
Range		9.5	1.9	1.7	1.7	4.0	.10	.5	214	133				181	163	4	10	

Table 3--Continued

Langdon, N. Dak.

Variety or Cross	State or N. No.	C. I. number	Acres yield	Test weight	Protein		Flour		Ab- sorp- tion time	Baking Methods and Loaf Volume										Average	
					Wheat	Flour	Yield	Ash		0	1	2	3	4	Aver. 3 best	Opt- imum	Weight of Loaf	Crumb Color	Grain texture	Score	Score
Ceres x H.T.F.	1552	12077	36.7	59.5	14.3	13.4	73.5	.48	57	2.0	830	945	1018	1004	989	1018	151	83	90	83	90
Renown		11947	30.7	59.1	14.7	13.8	72.0	.45	53	2.5	903	998	912		948	998	146	83	85	83	85
Rival		11708	35.7	57.5	14.6	13.8	73.0	.44	54	2.0	960	977	883		940	977	147	83	83	83	83
Regent		12070	34.0	58.5	14.8	14.0	70.9	.38	52	2.0	919	954	931		935	954	147	87	85	85	85
Cadet		12053	32.7	58.0	14.3	14.0	70.8	.43	57	2.5	940	948	931		940	948	149	85	83	83	83
Newhatch	Min2752	12318	32.3	57.6	15.0	14.5	71.8	.42	53	2.0	906	922	889		906	922	146	77	82	82	82
Thatcher		10003	31.2	57.8	14.1	13.5	72.5	.44	53	2.0	867	922	890		893	922	145	82	80	80	80
Vesta		11712	30.7	57.2	14.6	13.8	73.9	.43	52	3.0	824	922	795		847	922	147	80	87	87	87
Ms2809 x 2822	Ms3098	12360	26.7	56.4	15.2	14.0	73.1	.40	55	2.0	871	916	909		898	916	149	83	87	87	87
C.DCxMercury	Ms3103	12312	33.0	57.4	14.0	13.5	72.7	.47	54	2.0	910	905	909		908	910	151	87	90	90	90
Pilot	1098-13	11945	33.7	57.3	14.2	13.2	69.5	.43	53	2.0	848	903	892		881	903	145	82	88	88	88
C.DCxMercury	Ms2975	12300	38.2	59.1	13.8	12.6	76.3	.47	56	2.0	839	881	882	876	880	882	151	80	85	85	85
Mida	Ms2829	12008	35.8	59.0	13.9	13.4	73.9	.45	53	2.0	787	856	833		825	856	148	85	87	87	87
Premier,	Ms2772.40	12271	31.9	58.8	14.1	12.9	73.5	.45	54	2.0	795	842	842	781	826	842	148	92	90	90	90
Pilot x Mida	1750	12316	36.7	61.6	13.8	12.7	73.6	.42	54	2.5	781	795	750		775	795	150	97	85	85	85
Average Range			33.5 11.5	59.4 5.3	14.4 1.4	13.5 1.9	72.7 6.8	.44 .10	54 5	2.3 1.0	874 179	910 203			893 214	918 223	148 6	84 20	86 10		

Williston, N. Dak.

Regent		12070	43.2	61.1	15.4	14.8	73.8	.41	53	2.0	839	968	963		923	968	151	90	85	85	85
Newhatch		12318	46.5	59.7	15.2	14.8	73.0	.43	54	2.0	900	954	896		917	954	149	80	82	82	82
Rival		11708	44.5	59.6	14.8	14.1	75.5	.43	57	2.0	936	945	928		936	945	150	85	87	87	87
Ceres x H.T.F.	1552	12077	47.8	59.8	14.3	13.3	74.1	.45	54	1.5	789	892	942	856	897	942	150	80	88	88	88
C.DCxMercury	Ms3103	12312	47.8	59.5	14.3	13.9	74.8	.46	55	2.0	892	914	940	905	920	940	151	90	88	88	88
Merit x Pilot	1764	12315	49.9	60.0	14.3	13.8	74.3	.49	57	2.0	889	922	879		897	922	151	87	83	83	83
Thatcher		10003	49.6	60.8	14.2	13.2	73.7	.38	54	2.0	916	873	868		886	916	148	85	82	82	82
Mida	Ms2829	12008	44.9	61.5	14.1	13.5	77.1	.41	55	2.0	885	900	862		882	900	152	90	83	83	83
Cadet	1597	12053	48.3	60.1	13.2	12.7	75.0	.47	58	2.0	868	868	889	815	875	889	152	88	86	86	86
Pilot	1098-13	11945	52.0	60.0	13.4	12.2	71.4	.40	55	2.0	865	824	818		836	865	151	88	88	88	88
Ceres		6900	44.8	60.5	13.6	12.9	72.6	.41	56	2.0	801	806	789		799	806	151	82	86	86	86
Average Range			47.2 8.3	60.2 2.0	14.3 2.2	13.6 2.6	74.1 57	.43 .11	56 4	2.0 .5	875 162	894 174			888 137	913 162	151 3	86 8	86 6		

Table 3--Continued

Dickinson, N. Del.

Variety or Cross	State or N. No.	C. I. number	Acro yield Bu.	Test weight lbs.	Protein		Flour		Ab- sorption time Min.	Baking Methods and Loaf Volume					Average			
					Wheat		Flour			Milligrams of Bromate					Weight of Loaf Grams	Crumb Color Score	Grain texture Score	
					Pct.	Pct.	Pct.	Pct.		0	1	2	3	4				Aver. 3 best
RegentxMida Rival	1843	12430	20.0	60.4	14.0	13.4	74.1	.45	64	3.0	865	898	839	867	898	147	93	87
Cadet	1597	11708	22.6	60.3	13.5	12.3	75.3	.44	66	2.0	876	877	868	874	877	149	93	87
C.DCxMercury	Ns3103	12053	21.4	59.8	13.9	13.1	72.9	.39	66	3.0	853	856	868	863	868	150	93	88
Mida	Ns2329	12312	21.3	53.8	13.6	13.1	73.9	.44	62	3.0	800	854	839	831	854	147	100	93
RegentxPilot	1753	12003	23.4	61.9	13.8	12.3	73.6	.41	62	3.0	818	847	778	814	847	149	93	90
N1556x1563	1840	12317	21.0	60.7	13.2	12.1	72.9	.47	67	3.0	839	842	824	835	842	150	98	87
CeresxH.T.F.	1552	12413	16.4	57.6	13.1	12.4	72.9	.46	63	3.0	792	842	830	821	842	147	88	92
Newthatch	Minn2752	12077	17.4	59.3	13.6	12.5	71.4	.47	63	1.5	818	840	827	828	840	147	78	90
Ns2009x2822	Ns3096	12318	19.6	58.7	13.6	12.7	73.9	.50	64	3.0	807	821	789	805	821	149	87	92
Regent		12360	18.8	59.4	14.6	13.8	73.7	.43	64	1.5	809	818	815	814	818	150	95	90
Marquis		12070	19.7	58.8	12.6	12.1	72.9	.44	63	2.0	729	806	784	773	806	143	87	92
Ceres		3641	16.4	59.7	12.9	11.5	69.2	.42	61	2.0	744	804	767	772	804	147	90	88
Rel-HopexComet1121	1520	6900	16.8	58.4	13.5	12.7	69.8	.49	63	2.0	778	801	781	787	801	146	90	90
C.DCxMercury	Ns2975	12300	22.3	61.4	13.7	12.5	74.8	.39	62	2.0	701	793	739	789	793	146	82	88
CeresxH.T.F.	1556	12050	21.5	60.6	12.8	11.8	76.5	.47	64	1.5	744	793	786	774	793	149	83	88
Vesta	Ns2592	12263	18.6	59.7	12.9	12.2	71.7	.45	63	1.5	729	793	784	769	793	148	90	90
CeresxPilot	1535	11712	20.1	61.1	12.2	11.5	76.4	.40	63	2.0	773	789	758	775	789	148	92	88
Comet-PilotxComet 1121	1689	12367	18.7	58.5	12.8	12.1	72.9	.49	64	2.0	761	786	781	776	786	147	75	92
Thatcher		12262	21.1	60.2	11.9	11.5	73.4	.45	66	2.0	723	764	761	749	764	150	97	93
PilotxMida	1756	10003	20.2	59.3	12.3	11.7	72.9	.49	65	2.0	746	758	746	750	758	150	85	88
Premier, Sel	2772-40	12303	22.8	61.9	12.5	11.2	73.4	.36	62	2.0	744	755	720	740	755	147	97	90
PilotxMida	1750	12271	25.0	61.0	13.2	12.3	76.4	.44	65	2.0	729	729	709	722	729	151	87	87
Pilot	1098-13	12316	19.7	62.2	12.6	11.7	73.6	.41	63	2.0	723	671	655	683	723	149	88	88
		11945	20.1	60.0	11.5	10.2	71.7	.45	62	1.5	709	692	660	687	709	149	90	85
Average			20.2	60.0	13.1	12.2	73.3	.45	64	1.9	797	787		787	806	148	89	89
Range			8.6	4.6	3.1	3.6	7.3	.14	6	.5	205	242		191	189	5	25	8

Table 3--Continued

Havre, Mont.

Variety or Cross	State or N.No.	C. I. number	Acro yield Bu.	Test weight lbs.	Protein		Flour		Ab- sorption time min.	Baking Methods and Loaf Volume								Average	
					Wheat		Yield	Ash		Milligrams of Bromate				Avor. 3 best	Opt- imum	Weight of Loaf Grams	Crumb Color	Grain texture	Score
					Pct.	Pct.				0	1	2	3						
Cadet	1597	12053	27.8	52.5	17.2	16.8	70.3	.47	37	3.0	963	1116	1046	1042	1116	149	85	88	
Thatcher		10003	23.3	53.2	17.1	16.9	70.9	.47	35	2.0	1064	1092	1078	1078	1092	149	80	87	
Rel.HopexComet	1520-1	12343	27.5	52.3	17.2	16.3	70.2	.42	35	2.0	937	1047	1058	1018	1041	151	78	82	
Pilot	1098-13	11945	28.7	52.4	17.2	16.7	69.8	.42	35	2.0	965	1010	1009	977	999	151	22	92	
Newhatch	Min2752	12318	28.9	52.7	16.8	16.4	72.7	.51	35	2.0	971	1006	1006	1006	1006	152	80	92	
Marquis		3641	28.7	57.3	16.1	15.7	72.3	.46	35	2.0	954	968	953	958	968	150	85	90	
MeritzPilot	1764	12315	27.6	53.8	16.6	16.4	69.9	.51	37	2.0	942	963	945	950	963	154	83	92	
PilotxIda	1756	12303	30.1	53.7	15.9	15.5	72.2	.42	35	2.0	919	962	951	944	962	152	90	90	
Ceres		6900	28.0	53.6	15.4	14.9	72.6	.45	35	2.0	830	877	862	856	877	152	87	92	
Mida	Ms2829	12008	27.3	57.0	14.8	14.4	73.8	.45	35	2.0	830	871	853	851	871	151	92	90	
Average			28.3	54.5	16.4	16.0	71.5	.46	35	2.0	942	990		973	992	151	84	90	
Range			2.5	5.0	2.4	2.5	4.0	.09	2	-	234	254		227	245	5	12	5	

Moccasin, Mont.

Cadet	1597	12053	28.5	61.1	10.7	10.1	71.6	.42	37	846	677	655			659	677	155	92	88	
Rel.HopexComet	1520-1	12343	30.7	62.3	11.1	10.1	74.0	.39	32	649	674	666			663	674	154	77	85	
Marquis		3641	27.3	62.0	10.7	10.0	72.1	.46	32	654	663	615			641	663	154	78	82	
MeritzPilot	1764	12315	29.0	60.3	10.7	10.1	70.5	.47	39	646	660	643			650	660	160	32	82	
Newhatch	M.2752	12318	28.0	61.0	11.0	10.6	73.7	.49	32	626	654	542			607	654	153	73	73	
Mida	Ms.2829	12008	27.0	61.7	10.3	9.3	75.3	.43	32	649	645	640			645	649	153	85	83	
PilotxIda	1756	12303	28.2	62.5	10.1	9.1	72.2	.37	30	649	614	585			616	649	153	82	85	
Pilot	1098-13	11945	30.3	61.1	10.5	9.5	71.3	.40	31	600	629	576			602	629	151	87	82	
Ceres		6900	29.2	61.9	10.3	9.5	71.3	.44	32	612	621	559			597	621	153	82	78	
Thatcher		10003	28.9	61.3	10.5	9.9	74.1	.49	35	594	607	576			592	607	153	80	80	
CometxIda	1436-2	11931	29.5	62.4	10.5	9.8	74.1	.44	30	601	600	588			596	601	153	73	77	
CometxPilot	1585	12073	26.6	61.0	10.5	9.6	70.9	.53	32	596	581	577			585	596	155	75	78	
Average			29.0	61.6	10.6	9.8	72.6	.43	33	628	627				621	640	154	81	82	
Range			4.1	2.2	.8	1.5	4.4	.12	9	96	89				78	81	9	19	11	

Table 3--Continued

Sheridan, Wyo.

Variety or Cross	State or N. No.	C.I. number	Acre yield Bu.	Test weight lbs.	Protein		Flour		Ab- sorp- tion time Min.	Baking Methods and Loaf Volume					Weight of Loaf Grams	Average	
					Wheat		Yield	Ash		Milligrams of Bromate				Aver. 3 best Cc.		Crumb Color Score	Grain texture Score
					Pct.	Pct.				0	1	2	3				
PilotxMerit	1827	12352	17.4	59.1	16.0	14.9	71.3	.52	66	1.3	948	1223	954	975	1023	87	92
CometxPilot	1540-2	12274	14.7	60.0	16.5	15.3	70.9	.50	67	1.3	986	989	990	991	998	92	95
Pilot	1098-13	11945	19.6	60.0	15.8	14.5	69.8	.45	63	1.3	940	995	952	962	995	92	98
Marquis		3641	14.7	60.6	16.2	15.5	71.3	.53	65	1.3	980	986	933	921	966	88	96
Thatcher		10003	13.5	60.0	16.5	15.6	71.7	.51	64	1.3	886	922	931	960	941	35	92
Mida	Ns2829	12008	13.1	61.1	16.0	14.8	73.9	.52	65	1.3	886	956	911	892	920	87	92
RegentxPilot	1753	12317	12.9	59.8	16.7	15.2	68.2	.54	66	1.3	551	942	902	876	944	85	97
Ceres		6900	23.0	61.4	15.7	15.0	72.6	.52	66	1.3	508	948	919	925	948	85	92
C.-P.-C.R.H.	1689	12262	18.1	60.1	16.1	15.7	73.4	.52	68	1.3	908	948	919	925	948	95	95
MeritxPilot	1764	12315	19.6	58.7	16.7	15.0	71.6	.66	69	1.3	905	940	931	925	940	87	92
MidaCadet	1831	12363	14.7	60.1	16.1	15.2	72.9	.51	65	1.3	886	934	903	908	934	88	90
MeritxPilot	1792	12362	16.8	60.4	15.6	14.6	68.6	.53	67	1.5	862	934	882	893	934	93	95
Cometxll10	1466-2	11931	12.6	61.3	16.5	15.2	70.8	.51	65	1.5	930	931	899	920	931	90	97
C.-ll10xH.44-Ceres	1586	12276	18.4	61.3	15.1	14.1	72.5	.50	66	1.3	911	922	913	915	922	85	93
MeritxPilot	1652	12275	19.0	60.7	15.8	15.1	69.5	.51	68	1.3	878	916	882	892	916	88	95
CometxPilot	1585	12073	16.5	60.0	16.2	15.2	71.3	.51	67	1.3	871	911	865	882	911	77	82
Cadet	1597	12053	15.3	59.6	16.1	15.6	71.7	.52	68	1.3	874	900	889	894	900	88	93
N.1441xRenown	1933	12361	19.5	60.7	15.3	14.4	71.5	.51	67	1.3	847	865	839	850	865	92	90
Newthatch	M.2752	12328	13.1	59.0	17.1	16.2	69.8	.52	64	1.0	830	863	859	859	863	78	87
PilotxMida	1756	12303	21.4	62.6	14.5	14.4	71.7	.51	64	1.3	786	836	844	818	833	92	88
PilotxMida	1750	12316	19.0	62.0	15.5	14.1	72.0	.55	66	1.3	786	839	824	816	839	92	88
Comet		11465	15.3	59.6	14.7	13.9	71.5	.42	63	1.3	795	821	766	794	821	87	85
Cometxll21	1584	12258	19.0	61.3	14.5	13.3	70.2	.41	62	1.0	701	712	677	697	712	77	83

Akron, Colo.

MeritxPilot	1764	12315	12.4	59.0	17.0	16.5	70.5	.65	71	2.0	948	1227	965	980	1027	85	88
PilotxMida	1750	12316	11.5	61.6	16.1	15.2	71.6	.50	67	2.0	865	873	865	869	878	88	85
Reward		8182	12.5	60.3	14.1	13.4	71.3	.50	63	2.0	749	807	793	785	807	90	92
Average			12.1	60.5	15.7	15.0	71.1	.55	67	2.0	873	901		878	904	88	88
Range			1.0	2.6	2.9	3.1	1.1	.15	9	-	141	229		195	220	5	7

Table 4--Yield, milling, baking and chemical results for newer hard red spring wheats grown in single increase plots at three experiment stations in 1944.

Mandan, N. Dak.

Variety or Cross	State or N. No.	C. I. number	Acro yield Bu.	Test weight lbs.	Protein		Flour		Baking time min.	Baking Methods and Loaf w/				Weight of Loaf Grams	Crumb Color Score	Average
					Wheat		Ash			Filligrams of Bromate						
					Pct.	Pct.	Pct.	Pct.		0	1	2	3			
MidaxCadet	1831	12363	29.3	60.5	14.1	13.4	71.8	.50	65	1.5	766	781	755	781	151	85
MidaxCadet	1835	12441	29.7	60.7	13.7	12.8	72.3	.50	66	1.5	772	778	741	767	152	87
RegentxPilot	1753	12317	31.7	61.3	14.1	12.6	69.8	.51	65	1.5	776	772	723	756	152	85
MeritxPilot	1830	12364	29.3	60.2	13.5	12.8	69.2	.57	66	1.5	750	744	715	736	155	88
Marquis		3641	20.5	57.4	11.9	10.9	67.7	.52	65	2.0	706	744	701	717	150	78
MeritxPilot	1792	12362	29.6	60.3	13.3	12.9	67.7	.59	70	2.0	729	729	657	705	157	82
N.131xPilot	1807	12366	28.6	61.5	14.3	13.0	68.8	.47	65	1.5	712	692	638	681	151	85
PilotxMidx	1750	12316	20.1	62.2	13.1	12.5	71.2	.46	64	1.5	704	689	637	677	150	85
Thatcher		10003	30.6	60.5	12.4	11.4	71.0	.52	65	2.0	677	698	629	668	152	87
MeritxPilot	1764	12315	28.3	60.2	13.2	12.2	69.9	.53	66	2.0	680	660	636	659	155	85
Rel.-Hobart-M-Ceres 1797			28.0	61.3	12.6	11.9	71.0	.60	61	2.0	623	657	609	630	153	90
Pilotx1315	1829	12353	30.7	60.3	12.6	11.3	73.6	.45	61	2.0	631	649	604	628	153	83
N.144xRenown	1833	12361	24.1	61.0	12.9	11.5	72.9	.46	61	2.0	615	623	589	609	154	87
PilotxMidx	1826		29.9	60.7	12.2	11.1	72.1	.61	64	1.5	621	618	569	599	154	77
N.150x144C	1837		30.9	61.0	11.9	10.6	71.7	.51	64	1.5	615	612	579	602	154	80
Average			29.0	60.6	13.1	12.1	70.7	.52	63	1.7	692	696	652	680	153	84
Range			18.2	4.8	2.4	2.8	5.9	.15	.7	.5	133	169	196	169	7	11
1/ Milled on the Buhler mill.																
Langdon, N. Dak. (Arizona increases)																
Beart-112x1301	1919			60.0	14.2	13.4	73.3	.54	69	2.0	845	813	835	898	151	88
RegentxPilot	1920			57.7	13.7	13.2	72.0	.50	67	2.0	889	815	870	893	150	80
Regentx1322	1912	12448		57.2	13.9	13.4	72.5	.49	66	2.0	877	811	869	896	148	88
RegentxMerit	1913			56.6	13.2	12.8	70.5	.50	64	2.0	812	877	821	837	147	87
N.1415xPilot	1918			58.3	13.0	12.3	73.4	.51	65	2.0	812	847	805	823	150	82
Midax1573	1910	12447		60.3	13.6	13.2	71.6	.39	66	2.0	800	839	779	809	146	82
PilotxR.L.1067	1914			55.2	13.4	13.1	72.5	.49	65	2.0	729	818	800	782	146	82
N.1614xCadet	1917			57.1	12.3	11.5	71.7	.43	63	2.5	744	815	786	782	150	80
Regentx1155-22	1911			58.7	12.9	12.4	70.8	.44	63	2.5	716	812	798	775	148	87
N.156xMerit	1916			57.8	12.9	12.3	73.2	.45	67	2.0	733	806	772	772	153	83
Pilot2xCadet	1915			56.3	12.7	12.3	71.3	.47	66	2.0	716	801	789	769	151	83
Comet-PilotxCadet	1909			59.1	12.6	12.0	72.6	.41	64	2.0	735	798	739	754	146	87
Average				58.2	13.2	12.7	72.1	.47	63	2.1	817	835		816	150	86
Range				3.7	1.9	1.9	2.9	.13	.5		151	181		134	6	5

Table 4--Continued

Dickinson, N. Dak.
(Arizona increases)

Variety or Cross	State or N.No.	C.I. number	Acre yield	Test weight	Baking Methods and Loaf Volume										Average																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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					Protein		Flour		Ab- sorption time					Aver. 3 best	Opt- imum	Weight of Loaf	Crumb Color	Grain texture	Score																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
					Wheat	Flour	Yield	Ash		0	1	2	3							4	Cc.	Cc.	Cc.	Cc.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	in.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	C

1/ Yields influenced by dormancy-Mida seed not grown in Arizona.

Table 5--Field, milling, baking and chemical results on 26 wheats grown in the Uniform Regional Nursery for Eastern Composite, Western Composite, and averages of Eastern and Western Composites in 1944.

Eastern Composite

Variety or Cross	State No.	C.I. number	Acre yield	Test weight	Protein		Flour		Ab- sorp- tion	Min- ing time	Baking Methods and Loaf Volume					Average				
					Pct.	Ict.	Pct.	Yield			Ash	Billigrams of Bromate				Weight of Loaf	Crumb Color	Grain texture	Score	
												0	1	2	3					4
Bu.																				
Regent Pilot	1753	12317	25.7	59.2	14.4	13.8	72.9	.48	70	2.5	559	1004	995			925	1004	149	82	82
H-44 Marquis																				
x Thatcher	II-36-13	12309	24.9	58.7	14.5	13.4	73.4	.50	70	2.5	623	928	954	885		925	954	152	88	92
Rival x Thatcher	SD2280	12273	26.2	59.4	14.8	14.2	75.5	.48	68	2.5	633	945	913			897	945	150	88	92
H-44 Marquis																				
x Thatcher	II-36-1	12304	25.1	57.0	14.6	12.9	73.0	.48	69	2.0	632	942	914			926	942	151	90	93
Merit Pilot	1860	12355	27.6	58.4	14.5	13.9	72.9	.55	71	2.0	752	867	908	942		906	942	154	83	90
Mercury x Thatcher	II-36-67	12357	26.6	58.9	15.9	13.2	76.2	.53	70	2.0	645	940	914			900	940	151	98	90
Midax	1752	12312	28.7	59.3	14.5	13.7	76.5	.47	71	2.0	697	923	936	928		926	936	152	87	92
Rival x Thatcher	SD2259	12272	26.6	58.4	14.6	14.4	75.3	.46	70	2.5	623	936	916	909		920	936	151	93	90
Ceres H.T.F.	15 6	12263	27.9	58.9	14.0	14.0	74.6	.51	67	2.0	795	873	919	936		909	936	152	93	88
Mercury x Comet	1018	12310	22.7	55.9	13.1	14.7	74.4	.55	71	2.0	742	880	919	925		908	925	154	85	85
C.D.C. Mercury	Ms3111	12358	24.4	57.2	15.2	14.7	74.0	.55	67	2.0	671	925	923			906	925	149	87	93
Merit Pilot	1764	12315	28.3	58.3	14.5	13.8	72.1	.52	71	2.5	679	919	894			897	919	153	95	90
H-44 Marquis																				
x Thatcher	II-36-12	12356	25.3	58.3	14.4	13.7	72.7	.46	65	2.0	775	917	894			908	917	149	83	92
Ceres Pilot	1535	12263	21.5	56.1	13.7	12.8	70.5	.50	68	2.0	698	914	894			902	914	150	83	86
Thatcher	10003		21.7	57.1	14.5	14.0	73.5	.49	66	2.0	681	914	891			899	914	149	90	90
H-44 Marquis	FL1527	12302	22.8	56.5	14.1	13.4	72.7	.54	65	2.0	679	914	876			890	914	148	87	90
Pilot x 1315	1029	12353	28.4	57.5	14.5	13.5	74.8	.52	66	2.0	665	906				899	906	150	90	83
Pilot x Merida	1756	12303	29.0	60.8	14.8	13.1	74.1	.37	65	2.0	603	881	821			869	906	149	92	90
Henry	11-333	12265	26.7	58.3	14.5	12.6	75.2	.47	64	2.0	630	870	903	848		874	903	148	82	83
Mercury x Thatcher	II-36-24	12307	24.0	57.1	14.5	13.4	75.6	.54	69	2.0	642	848	903	833		864	903	153	93	90
Ns2809-2822 x Premier	Ms3095	12359	24.8	58.6	14.7	15.2	75.2	.59	69	2.0	731	859	900	879		879	900	154	90	90
Pilot x Merit	1827	12352	25.7	57.1	14.8	13.3	73.5	.56	68	2.0	668	894	892			885	894	151	87	90
Ns3096	Ms3096	12360	20.6	55.6	14.6	15.3	75.1	.51	69	2.0	761	873	870			835	873	153	90	87
C.D.C. Mercury	Ns2849	12198	30.7	61.0	14.3	13.3	75.1	.47	66	2.0	721	862	830	824		839	862	150	95	90
Pilot x Merida	1750	12316	28.3	61.5	14.1	13.3	73.5	.49	65	2.0	603	795	780			813	836	149	92	90
Marquis	3641		10.2	51.4	15.0	12.1	68.4	.56	64	2.0	694	795	809	798		801	809	148	93	85

1/ From the Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo and breeding stations.

Table 5--Continued

Western Composite 1/

Variety or Cross	State or N.No.	C.I. number	Acro yield	Test weight	Protein		Flour		Ab- sorption time	Baking Methods and Loaf Volume					Average				
					Wheat		Yield			Milligrams of Bromate					Crumb Color	Grain texture			
					Pct.	Pct.	Pct.	Pct.		0	1	2	3	4			Aver. 3 best inum Co.	Weight of Loaf Grams	
					Pct.	Pct.	Pct.	Pct.		Co.	Co.	Co.	Co.	Co.					
MercuryxThatchor	II-36-13	12309	29.6	59.0	14.5	13.4	72.2	.47	63	2.0	842	908	827		859	908	149	90	92
PilotxMerit	1827	12352	28.3	53.2	14.2	13.1	72.7	.48	63	2.0	842	897	824		848	897	152	88	88
MeritxPilot	1764	12315	29.7	58.4	14.5	13.8	70.4	.42	68	2.0	839	896	845		860	896	152	88	92
RegentxPilot	1753	12317	28.3	59.7	14.2	13.3	68.4	.36	65	2.0		874	894	845	871	894	148	77	88
Thatchor		10003	31.0	53.5	15.0	14.3	73.4	.46	63	2.0		859	897	833	862	894	150	85	90
MercuryxThatchor	II-36-67	12357	28.5	59.0	14.1	13.5	75.6	.51	63	2.0	854	894	818		855	894	151	85	87
H-44-MarquisxTha.	II-36-1	12304	30.6	59.4	14.8	13.9	73.0	.46	65	2.0	888	893	851		877	893	149	85	88
MidaxCadot	1752	12321	30.5	60.0	14.0	13.0	74.4	.39	66	2.0		856	885	865	869	885	150	83	92
H-44-MarquisxTha.	II-36-12	12356	32.7	59.4	14.3	13.9	73.5	.48	65	2.0	850	885	839		858	885	150	82	88
CeresxH.F.F.	1556	12263	28.1	50.5	15.1	14.0	71.9	.46	70	2.0		865	865	883	371	883	154	88	88
C.DCxMercury	Ns3111	12358	26.4	59.6	14.5	14.0	74.2	.48	67	2.0	842	881	851	806	858	881	152	90	93
MeritxPilot	1860	12355	30.0	59.0	14.3	13.6	70.8	.48	69	2.0		821	856	879	861	879	153	85	88
2809-2822xPremier	Ns3095	12359	25.4	60.1	14.6	14.1	73.8	.42	71	2.0		833	859	839	844	859	154	90	88
MercuryxThatchor	II-36-24	12307	26.2	53.1	13.9	12.9	74.8	.52	71	2.0	772	853	786		804	853	155	85	88
Henry	Wis.233	12265	34.0	59.4	13.5	12.6	74.6	.47	65	2.0	806	850	847		834	850	151	77	78
MercuryxComet-1018	Ns.2822.6	12310	29.6	53.9	14.3	13.5	75.7	.49	69	2.0	732	850	815		799	850	154	78	85
Marquis		3641	25.7	53.8	14.1	13.7	72.8	.47	63	2.0	842	845	821		836	845	151	83	92
Pilotx1315	1829	12353	28.1	57.6	14.5	13.6	73.5	.44	67	2.0	812	844	815		824	844	153	78	88
H-44xMarquis2	RL.1527	12302	27.3	58.1	13.5	12.8	72.1	.47	65	2.5	801	842	801		815	842	151	77	82
CeresxPilot	1535	12367	27.5	58.0	14.0	13.1	73.1	.51	63	2.9	809	833	787		810	833	152	78	93
PilotxMida.	1756	12303	31.1	61.0	14.0	13.0	72.4	.40	65	2.0	783	824	795	783	801	824	152	93	93
RivalxThatchor	SD.2259	12272	29.3	59.0	14.4	13.6	71.6	.37	65	2.0		815	818	806	805	818	149	88	93
NS2809x2822	Ns3096	12360	26.1	53.5	14.7	13.9	73.7	.37	63	2.0	767	818	806		797	818	152	90	92
RivalxThatchor	SD.2280	12273	29.5	59.7	14.7	13.9	72.9	.38	65	2.0	800	812	798		803	812	149	83	92
C.DCxMercury	Ns2849	12198	31.8	61.0	14.1	13.7	74.4	.46	63	2.0	778	778	738		765	778	150	87	90
PilotxMida	1750	12316	29.2	61.8	13.7	12.8	72.6	.44	69	2.5	775	747	709		744	775	155	88	85
Average			24.0	59.2	14.3	13.5	73.0	.45	67	2.0		849	825		832	857	151	85	90
Range			8.3	4.2	1.6	1.7	7.3	.16	8	.5		161	185		133	133	7	16	15

1/ From the Dickinson, Havre, Moccasin and Arnon Stations.

Table 5--Continued

Average of Eastern and Western Composite

Variety or Cross	State or N.No.	C.I. number	Acres Yielded	Test weight Bu. lbs.	Protein		Flour		Ab- sorb- ing value	Baking Methods and Loaf Volume					Average			
					Wheat	Flour	Yield	Ash		Milligrams of Bromate					Opt- imum Cc.	Weight of Loaf Grams		
										0	1	2	3	4				
																	Pct.	Pct.
RegentxPilot	1753	12317	27.9	59.5	14.3	13.6	70.7	.42	83	3.3	919	949	920		929	149	80	85
MercuryxHatcher	II-36-13	12309	27.3	59.9	14.5	13.4	72.8	.49	68	2.3	901	878			892	151	89	92
H-44-MerquisxTha.	II-36-1	12304	27.9	57.7	14.7	13.4	73.0	.47	67	2.0	908	897			902	150	88	91
MercuryxHatcher	II-36-67	12357	27.6	59.0	14.0	13.4	75.9	.52	89	2.9	869	879			878	151	87	89
MidexCadot	1752	12312	29.6	59.7	14.2	13.4	75.5	.43	89	2.0	877	904	901		899	151	85	92
MeritxPilot	1860	12355	28.6	59.7	14.4	13.6	71.9	.52	70	2.0	787	862	894	895	884	154	84	89
CeresxH.P.F.	1556	12263	28.0	59.2	15.0	14.0	73.3	.49	69	2.0	830	869	901	871	890	154	91	88
MeritxPilot	1764	12315	29.0	5.4	14.5	13.8	71.3	.47	70	2.5	888	882			879	153	92	91
Thatcher		10003	26.4	57.8	14.7	14.2	73.5	.48	63	2.0	875	904	862		881	150	88	90
C.DCMercury	Ms3111	12358	25.9	56.4	14.9	14.4	74.1	.52	87	2.0	876	888			879	151	89	93
H-44-MerquisxTha.	II-36-12	12356	29.0	56.9	14.4	13.8	73.1	.47	65	2.0	901	876		813	883	150	83	90
PilotxMerit	1827	12352	27.0	57.7	14.2	13.2	73.1	.52	63	3.0	883	859			862	152	88	89
MercuryxComet-1018	Ms2822.6	12310	26.2	57.4	14.7	14.1	75.1	.52	70	2.0	796	848			854	154	82	85
Ms2809-2822xPremier	Ms3095	12359	25.1	58.5	15.2	14.7	74.5	.51	70	2.0	797	869	870		862	154	90	88
RivalxHatcher	SD2280	12273	27.9	59.6	14.8	14.1	74.2	.43	57	2.3	823	872			850	150	86	92
H-44-Merquisx2	RI1527	12302	25.1	57.3	13.8	13.1	72.4	.51	55	2.3	861	858			853	150	82	86
MercuryxHatcher	II-36-24	12307	25.1	57.3	14.1	13.2	75.2	.53	70	2.0	843	817			834	154	89	89
RivalxHatcher	SD2259	12272	28.0	56.7	14.5	14.0	74.0	.42	66	2.3	876	867	846		863	150	91	92
Henry	Wis.233	12265	30.4	58.9	13.5	12.6	74.2	.47	63	2.0	840	859			854	150	80	81
Pilotx1315	1829	12353	28.3	57.6	14.4	13.6	74.2	.49	67	2.0	865	861			862	152	84	86
CeresxPilot	1535	12367	24.5	57.1	13.9	13.0	71.8	.51	67	2.0	866	851			856	151	81	91
PilotxGda	1756	12303	37.1	59.0	13.8	13.1	73.3	.39	85	2.0	865	838		769	835	151	93	92
Ms2809x2822	Ms3096	12360	23.4	57.1	15.2	14.6	74.4	.41	60	2.0	790	840			816	153	90	90
Marquis		13641	18.0	55.1	13.6	12.9	70.6	.52	64	2.0	815	803			819	150	88	89
C.DCMercury	Ms2849	12198	31.3	61.0	14.2	13.5	74.6	.47	63	2.0	820	784			802	150	91	90
Pilotx1315	1750	12316	28.3	61.7	13.9	13.1	73.1	.47	57	2.3	792	792	752		779	152	90	88
Average			27.1	59.3	14.4	13.6	73.5	.48	66	2.1	853	860			861	151	87	89
Range			13.3	6.3	1.7	2.1	5.3	.14	6	1.5	129	198			150	5	13	12

Table 6--Yield, milling, baking and chemical results on hard red spring wheats grown in North Dakota and Montana Intra-State Nurseries composited from stations indicated, 1944 crop.

Fargo, Langdon and Dickinson Composite

Variety or Cross	State or N.No.	C.I. number	Acres Yield	Tost weight	Protein		Flour		Ab- sorbing time	Baking Methods and Loaf Volume										Average	
					Wheat	Flour	Yield	Ash		0	1	2	3	4	Aver 3	Opt- imum	Weight of Loaf	Crumb Color	Grain Texture		
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	min.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Grams	Score	Score		
Newhatch		12318	26.9	59.0	16.1	15.6	73.0	.42	62	2.0	1012	1067	980		1020	1067	145	70	78		
RegentxPilot	1852	12365	23.3	59.0	15.9	14.8	70.3	.43	64	2.5	971	1050	1001		1007	1050	145	80	80		
N.156x1563	1840	12431	32.9	57.6	15.5	14.7	72.6	.41	64	2.0	937	1028	962		976	1028	147	83	87		
MeritxPilot	1830	12364	29.5	58.3	15.8	15.0	70.3	.48	67	2.0	893	1012	974		960	1012	151	77	85		
Ns.2794.45	Ns3111		27.5	57.7	15.8	15.5	73.0	.48	65	2.0	894	998	945		946	998	150	80	83		
MidaxCadet	1831	12363	30.6	60.0	15.2	14.4	73.4	.45	66	2.0	910	995	953		953	995	150	82	85		
Ns.2822x2809	Ns3165		27.1	58.1	16.6	15.9	73.5	.47	68	2.0	882	992	984		953	992	151	80	85		
Rel.Hopexi-44-Ceres	1797		27.6	59.4	15.0	14.6	73.2	.49	68	2.0	953	992	901		949	992	151	77	85		
RegentxMida	1843	12430	34.3	60.9	16.3	16.1	73.0	.42	64	2.5	900	983	939		941	983	148	80	87		
MidaxCadet	1835	12441	31.6	60.0	14.9	14.6	74.6	.48	63	2.0	898	980	909		929	980	147	83	85		
Ns2822-2809xPremier	Ns3164		29.3	59.9	16.2	15.7	76.8	.52	65	2.0	862	974	940		925	974	149	77	82		
Cometx121	1609		29.9	59.3	15.4	14.8	73.7	.36	62	2.0	881	974	889		915	974	148	73	83		
H-R-RxR-R	1742		28.0	57.5	15.9	15.3	70.5	.49	60	2.0	916	962	853		910	962	149	77	82		
MeritxPilot	1792	12362	30.9	59.0	15.3	14.5	70.3	.47	66	2.5	896	957	882		912	957	149	82	88		
Ns2822x2809	Ns3129		28.1	57.3	15.8	15.0	74.3	.39	62	2.0	809	948	905		887	948	149	83	87		
PilotxMida	1769	12324	37.2	60.9	14.9	14.1	72.1	.39	62	2.0	882	936	839		886	936	148	83	85		
Ns2822-2809xPremier	Ns3150		30.3	60.0	15.5	15.0	74.5	.50	62	2.0	848	923	876		882	923	148	80	85		
N.1131xPilot	1907	12366	29.7	61.6	15.0	14.4	70.0	.41	62	2.5	876	919	853		883	919	147	78	85		
Ns2822xPremier	Ns3142		28.0	59.7	14.8	14.4	75.2	.40	62	2.0	862	911	830		868	911	149	82	87		
N.1441xRenown	1833	12361	31.0	60.6	14.7	14.1	72.9	.43	65	2.5	845	910	906		887	910	149	78	85		
PilotxMida	1826		35.2	60.8	15.3	14.1	71.1	.41	62	2.0	882	905	881		889	905	147	83	87		
MercuryxKumar-Kussar	1736		31.7	60.2	14.8	14.3	73.7	.45	65	2.0	842	905	789		845	905	149	78	83		
Ns2822x7.29.14.6	Ns3145		27.0	59.9	15.3	14.4	74.8	.44	64	2.0	865	879	830		858	879	150	72	80		
C.DC Mercury	Ns2852		33.3	60.0	14.9	13.6	75.1	.46	62	2.0	839	842	815		832	842	147	85	85		
Average			30.0	59.4	15.5	14.8	73.0	.44	64	2.1	899	954			917	960	148	79	84		
Range			13.9	4.3	1.8	2.3	6.8	.16	6	.5	211	225			188	225	6	15	10		

Table 6--Continued

Moccasin and Havre Composite

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Variety or Cross	State or N.No.	C.I. number	Acres Yield	Test weight	Protein		Flour		Ab- sorption time	Baking Methods and Loaf Volume					Weight of Loaf Grams	Crumb Color	Grain texture Score	
					Theet		Yield	Ash		Milligrams of Bromate				Aver. 3 best				Opti- mum
					Pct.	Pct.				0	1	2	3					
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Co.	Co.	Co.	Co.	Co.	Co.			
N.1449xPilot	2088		29.6	50.3	14.6	14.2	72.1	.40	0	312	931	923		915	931	83		
Thatcher		10003	30.3	57.7	14.6	14.2	72.8	.46	0	354	910	897		887	910	83		
PilotxMerit	1969		31.0	58.0	14.3	13.6	72.0	.50	0	351	865	901	798	872	901	83		
ThatcherxCeres	1947		33.4	58.8	14.4	14.0	71.5	.43	0	356	879	821		852	879	88		
ThatcherxMeris	1946		28.1	59.0	14.6	14.1	71.8	.49	0	842	876	853		857	876	88		
RegentxPilot	1952		31.8	58.3	13.8	13.3	69.7	.40	0	365	869	812		845	865	87		
PilotxMida	1979		28.8	55.1	13.8	13.2	71.8	.49	0	323	862	818		835	862	87		
N.1449xPilot	1855		31.6	58.6	14.1	13.6	71.2	.39	0	809	818	856	792	828	856	88		
Meritx1315	1948		30.8	56.2	14.1	13.5	73.0	.44	0	812	806	850	752	823	850	90		
PilotxMida	1769	12324	28.6	58.3	14.0	13.5	69.9	.41	0	789	842	848	761	826	848	88		
Comet-1110-Pilot	1663-1		28.4	50.8	14.3	13.8	72.6	.39	0	803	848	795		815	848	88		
PilotxMerit	1863		28.6	57.3	14.4	13.5	69.2	.47	0	798	845	799		811	845	83		
PilotxMerit	1898	12442	28.7	57.3	14.4	13.9	69.9	.43	0	806	841	842	761	830	842	87		
N.1248xMerit	1798		29.3	57.0	14.8	14.4	73.3	.51	0	767	839	790		799	839	88		
PilotxMida	1953	12445	28.8	58.4	13.9	13.5	70.9	.33	0	806	836	836	766	826	836	85		
PilotxMida	1773		30.9	57.3	14.1	13.2	70.7	.32	0	827	830	804		820	830	88		
N.1449xPilot	2087		31.0	58.3	14.1	13.6	72.3	.39	0	818	827	778		808	827	83		
Ceres		6900	30.9	59.3	14.2	13.8	70.8	.45	0	813	824	809		815	824	87		
Pilot	1674		26.3	58.6	13.8	13.0	73.3	.45	0	798	824	821		814	824	83		
N.1441xRenown			30.7	57.0	14.5	13.6	69.2	.40	0	306	821	821	821	820	821	87		
MeritxPilot	1792	11945	29.3	58.2	14.5	13.8	70.4	.49	0					799	812	85		
Pilotx1315	(1342A-1-17-2-1)		28.1	57.0	12.8	12.1	71.0	.44	0	798	810	798		802	810	85		
N.1511x1315-15	(1325A-1-21-4-1)		26.2	58.7	14.9	14.5	71.1	.42	0	789	806	798		798	806	85		
Regentx1315	1950		34.1	57.0	14.0	13.3	72.5	.41	0	792	806	786		795	806	87		
MidaxCadet	(1332A-1-9-1-3)		27.7	58.3	13.9	13.5	71.9	.44	0	751	806	800		789	806	85		
Midaxl529	1949		29.5	58.0	13.3	12.5	71.6	.47	0	803	800	780		794	803	85		
1615xPilot	1902		29.7	57.3	14.4	13.5	69.0	.47	0	739	798	789		785	798	90		
MidaxCadet	(1332A-1-9-2-1)		25.4	57.0	13.2	12.3	71.9	.48	0	747	786	775		769	786	82		
Midaxl315	(1341A-2-1-3-1)		27.3	59.4	13.4	12.5	72.2	.39	0	752	783	738		758	783	85		
Rel-HopexComet-1121	(1251A-1-21-1-2)		26.7	58.7	13.7	12.9	71.4	.41	0	744	712	763		760	772	85		
Meritx1315	1992		30.6	57.7	13.8	12.9	69.1	.39	0	738	767	749		755	767	87		
Pilotx1315	1941		30.8	58.4	12.7	12.0	69.5	.32	0	738	758	741		746	758	87		
Midaxl574	(1333A-1-5-2-1)		26.4	58.1	14.9	14.5	72.9	.39	0	726	727	671		708	727	88		
Average			29.4	58.4	14.1	13.4	71.3	.43	0	809	820			811	828	87		
Range			8.7	5.5	2.1	2.4	4.3	.19	0	205	196			207	204	10		

Table 7.--Yield, milling, baking and chemical results on hard red spring wheats grown in the station nurseries at Langdon, Dickinson and Bozeman in 1944.

Langdon, N. Dak.

Variety or Cross	N. No.	C. I. number	Acres Yield	Test weight lbs.	Protein		Flour		Ab- sorb- tion time	Baking Methods and Loaf Volume					Weight of Loaf Grams	Average			
					Wheat		Yield	Ash		Milligrams of Bromate						Opt- imum Cc.	Crumb Grain Color texture Score	Score	
					Pct.	Pct.				0	1	2	3	4					Aver. 3 best Cc.
MidaxCadet	1962		28.6	50.6	13.8	13.3	74.8	.42	64	2.0	877	931	862	890	931	149	87		
PilotxMida	1785		26.5	50.5	13.6	13.1	74.4	.38	64	2.0	865	913	873	884	913	150	93		
Rel-HopexH-44-Ceres	1706		24.5	50.7	14.8	14.3	72.9	.39	67	2.0	842	900	845	862	900	152	82		
MidaxH529	1965		30.7	50.5	12.8	12.1	73.2	.35	63	2.5	876	894	800	857	894	148	90		
RegentxPilot	1868		26.7	50.7	14.9	13.9	71.9	.39	64	2.0	885	882	807	858	885	150	92		
N.1504x1448	1837		27.4	50.0	13.4	12.5	71.7	.41	62	2.0	813	876	804	831	876	148	87		
PilotxMida	1964		30.4	50.0	12.9	11.9	73.4	.32	59	2.5	833	871	769	824	871	146	92		
Comet-1140-Pilot	1838		26.7	50.0	14.3	13.4	69.4	.34	62	2.0	815	871	749	812	871	149	83		
Comet-1141-H-44-Ceres	1966		26.5	50.4	13.4	12.4	72.4	.35	65	2.0	842	850	772	821	850	150	75		
N.1441x1508	1703		28.3	50.1	13.3	12.3	73.3	.34	64	2.0	815	833	723	790	833	151	85		
Mida	12008		27.6	50.0	13.8	12.8	73.2	.35	62	2.0	815	824	775	804	824	150	95		
PilotxMida	1775		32.0	51.5	14.0	13.3	72.1	.29	62	2.5	764	815	809	796	815	149	93		
PilotxMida	1751		34.5	51.1	13.2	12.3	72.8	.37	60	2.0	755	812	726	764	812	147	92		
N.1441x1441	1848		25.3	50.8	14.4	13.6	72.5	.33	60	2.5	655	749	692	699	749	147	83		

Dickinson, N. Dak.

RegentxMida	1890		32.7	50.1	15.5	15.1	74.9	.44	66	2.0	945	1010	945	967	1010	88	85
N.1556x1563	1997		32.5	50.0	15.4	14.8	74.9	.48	62	1.5	905	954	922	927	954	85	88
H-44-1018x2791	1998		31.4	54.5	15.3	14.3	75.2	.48	64	1.5	873	934	909	905	934	72	90
RegentxMida	1844		27.1	51.1	14.9	14.4	75.4	.45	65	2.0	911	928	911	917	928	87	87
RegentxMida	1889		36.7	50.0	14.7	14.1	74.3	.46	62	2.0	892	928	855	892	928	92	90
MercuryxH.	1801		31.8	50.3	14.7	14.2	75.8	.47	66	2.0	903	913	859	892	913	87	87
H-44-1018x2791	1809		27.2	55.0	15.1	14.1	72.5	.47	64	1.5	896	893	912	900	912	72	85
Mida	12008		38.0	50.3	15.8	14.8	74.8	.42	64	2.0	874	902	894	890	902	85	85
MercuryxH.	1999		42.9	50.5	15.3	14.3	74.9	.53	64	1.5	801	862	850	838	862	87	90
Average			33.4	50.6	15.2	14.5	74.7	.47	64	1.6	901	921		903	927	84	87
Range			15.6	6.6	1.1	1.0	3.3	.11	4	5	83	160		129	148	20	5

Table 7--Continued

Bozeman, Montana

Variety or Cross.	N. No.	C. I. number	Acres yield	Test. weight	Protein		Flour		Ab- sorption	Baking Methods and Loaf Volume					Average	
					Wheat	Flour	Yield	Pct.	Pct.	Milligrams of Bromate	Aver. 3	Opt- imum	Weight of Loaf	Crumb Color	Grain texture	Score
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	0	1	2	3	4	Grams	Score
Pilotx1441-Tonown	1991		34.7	62.0	13.1	12.2	73.0	.44	84	2.0	772	795	744		150	85
Ceres		6900	35.8	63.3	13.1	12.4	75.0	.49	89	2.0	781	789	778		154	83
PilotxRegent	(1357A-2-2-2-1)	37.7	62.5	63.1	13.2	12.8	76.3	.43	68	2.0	764	784	784	772	151	85
PilotxMerit	1996		44.1	63.1	12.6	11.7	73.6	.37	63	2.0	749	772	715		150	85
Pilot		11945	46.7	62.4	12.4	11.3	72.2	.35	89	2.0	709	758	702		150	85
Midax1574	(1333A-1-7-1-2)	34.1	64.3	64.3	12.9	12.4	72.9	.47	66	2.0	732	755	704		152	87
MeritxPilot	1791		45.0	61.7	13.2	12.7	72.8	.45	69	2.0	744	747	712		153	83
PilotxMerit	1993		45.3	61.7	12.2	11.2	73.2	.33	87	2.0	733	747	723		151	87
Thatcher		10003	45.5	62.9	12.6	11.9	74.0	.47	64	2.0	726	729	720		150	88
Comet-PilotxComet-1121	1683		45.0	61.3	12.3	11.6	73.3	.38	64	2.0	715	721	701		152	85
Midax1315	(1341A-2-1-2-8)	38.2	64.2	64.2	13.0	12.3	74.9	.45	87	2.0	704	689	666		156	83
Pilotx1315	2090		45.3	62.7	12.6	11.9	73.9	.45	87	2.0	690	703	692		154	87
Average			41.5	62.3	12.8	12.0	73.8	.43	83	2.0	741	736			152	84
Range			12.8	3.7	1.0	1.6	4.1	.14	3	2	100	129			6	5

BROMATE RESPONSE METHODS.

Samples of 4 hard red spring wheats and 4 hard red winter wheats were again obtained from Sheridan, Wyo., where they were grown on similarly prepared fallow to determine if comparable high protein spring wheats would respond to increasing amounts of bromate as has been found characteristic of the winter wheats. This is the 4th season such samples have been collected and tested. The response to varying amounts of potassium bromate (0 to 5mg per 100 g. of flour) for the 1944 samples and a summary of the data for 4 years is shown in table 3. Samples of each of the 8 varieties were milled on the Buhler mill.

The baking results show that the bromate requirements for the 1944 winter wheats averaged higher than those of the spring wheats. It should be pointed out that the flour protein was nearly the same with the winter wheats, averaging only slightly higher than the spring wheats. This year's results appear to be in general agreement with those of the 1941 crop. In the 1944 winter samples three of the flour varieties needed 3 and 4 mgs. of bromate as compared with the spring samples where 3 varieties required 1 and 2 mgs. of bromate for optimum results. The baking results for the 1943 samples showed that the spring and winter wheats responded alike requiring 2 and 3 mgs. of bromate, and in 1942 required approximately 2 mg. of bromate. In 1941, however the winters required a higher percentage of bromate averaging 3 mg. for optimum results as compared with the spring wheats which required a maximum of 2 mg. for best results. There was less differences in the average bromate response between the two classes of wheat in 1942 and 1943 than in either of the other 2 years. In both of these years (1942-1943) the average flour protein content was highest on the spring wheats averaging 2.0 percent more for the 1942 samples. A summary of the four years' results shows the hard red spring wheats to average higher in protein and loaf volume but to have slightly lower bromate requirements as compared with the winter wheats.

U.S.D.A., NORTH DAKOTA AND MINNESOTA METHODS

The same composite flours of seven uniform varieties for the eastern and western sections were baked a fifth year by different methods including those used by the North Dakota and Minnesota laboratories. The results from the U.S.D.A. laboratory using the North Dakota and Minnesota methods and the present and former U.S.D.A. methods are shown in table 9.

The results from the Minnesota methods show that the 2-hour fermentation and the 2-minute mix gave the best results. This is in general agreement with other years data. Two of the varieties, Regent and Cadet, from the Eastern Composite averaged the same for the 2 and 3 hours fermentations. The loaf volumes are again lower than either of the former or present U.S.D.A. methods and the North Dakota methods. These lower loaf volumes are due in part to the Minnesota method of scaling doughs to a uniform weight of 150 grams for all varieties, a practice not followed by the other laboratories.

The Eastern Composite samples baked by the Minnesota methods averaged higher than the Western Composite samples in loaf volume, while the protein content is lower. Certain varieties, especially Rival and Mida from the Eastern composite, and Newhatch, Marquis, and Pilot from the Western Composite appear to be severely injured by long (3-hour) fermentations. The varieties have been ranked in descending order of loaf volume for all the baking methods used, with the average rank and loaf volume of all 10 methods included for comparative purposes. The data suggest that of the two Minnesota methods the 2-minute mix and 2-hour fermentation method ranks the varieties better as compared with the averages for all 10 methods.

The results from the North Dakota malt-phosphate bromate method shown in table 9 are given for both the 2- and 3-hour fermentation periods. As with the Minnesota methods, the 2-hour fermentation period gave the best results. The Western Composite samples baked by the North Dakota 2-hour fermentation method averaged slightly higher than the Eastern Composite samples in loaf volume. The Eastern Composite samples averaged lowest in protein content. The loaf volumes by the North Dakota methods averaged higher than the Minnesota methods but were lower than the U.S.D.A. methods. Cadet, Newhatch, and Regent appear to have greater fermentation tolerance than the other varieties as judged by the 3-hour fermentation period test. Results of the two methods used show that the 2-hour fermentation method ranked the varieties better as compared with the average ranking of all methods.

The results from the U.S.D.A. tests are given for the present method (modification of the No. 6 method) and two former methods No. 2 and No. 3. The optimum loaf volumes by the present U.S.D.A. methods produced higher loaf volumes than either the No. 2 or No. 3 methods. The optimum loaf volumes for the Eastern Composite samples average slightly higher than those from the Western Composite. Although the Western Composite samples have generally been highest in protein. The present U.S.D.A. methods appear to be a more satisfactory measure of quality than those formerly used. In ranking the varieties the optimum loaf volumes appear to be as satisfactory as the average of the 3 best volumes, when compared with the average ranking from all 10 methods. The average of the 3 best bakes, however, may reveal a greater tolerance in some varieties.

The volumes for the different laboratory methods and averages for 10 methods shown in table 9 have been arranged in descending order of the average loaf volume. For the Eastern Composite Newthatch, Rival, and Regent and for the Western Composite Thatcher, Newthatch, and Cadet led. The average of the Eastern and Western Composite shows Newthatch, Cadet, and Thatcher to be best.

COMMERCIAL SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Grain Branch, Production and Marketing Administration, for comparison with the varieties and strains produced in experimental plots. Ten such samples, representing a number of grades and types, were obtained at Minneapolis, Minn., Spokane, Wash., and Great Falls, Mont. The samples were composited by grade from 2227 cars of wheat grading No.3 or better and represent the better grades of hard red spring wheats received at these markets. The quality results are given in table 10, scatter diagram and regression line in figure 4 and protein content--loaf volume comparison in table 11.

These samples generally averaged lower in protein content than the experimental plots and nursery samples. Otherwise the milling, baking, and chemical results do not appear to be greatly different, especially when compared with samples having approximately the same protein content and test weight. The correlation coefficient for loaf volume and protein content also was low in comparison with 14 selected varieties and strains. The protein quality however was high as based on the loaf volumes adjusted to a 13.0 percent protein basis in comparison with other varieties from experimental plots and nurseries.

Table 8--Yield, milling, baking and chemical results on 4 hard red spring wheats and 4 hard red winter wheats, milled on the Buhler Mill and baked to show bromate response on the two classes of wheat, grown on comparable fallow land at Sheridan, Wyo., 1944, together with a 4-year summary.

Class and Variety	C. I. number	Acres yield	Test weight	Protein		Flour		Absorption	Mixing time	Baking Methods and Loaf Volume					Average			
				Wheat	Flour	Yield	Ash			Milligrams of Bromate					Wt. of Loaf	Crumb Color		
										Pct.	Pct.	Pct.	Pct.	Pct.			Pct.	
																		0
	Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Cc.	Cc.	Cc.	Optimum	Score	Score
Hard Red Spring Pilot	11945	19.6	60.0	15.7	14.4	69.8	.49	62	1.25	922	939	929	930	939	149	92	95	95
Thatcher	10003	13.5	60.0	16.3	15.5	68.3	.52	62	1.25	833	883	922	898	922	149	85	91	91
Ceres	6900	23.0	61.4	15.6	14.9	71.8	.52	64	1.25	905	916	862	894	916	151	83	90	90
Mida	12008	13.1	61.1	15.2	15.0	72.4	.50	64	1.25	853	916	873	881	916	152	93	97	97
Average		17.3	60.6	15.9	15.0	70.6	.51	63	1.25	897	889		901	923	150	88	93	93
Hard Red Winter																		
Minturki	6155	12.2	58.3	15.3	14.8	69.1	.47	60	1.25	909	922	942	935	942	148	83	94	94
Nebred	10094	18.0	60.3	16.7	14.8	70.9	.42	62	1.25	925	934	942	934	942	149	80	91	91
Kanred	5146	17.5	59.1	14.3	13.8	73.4	.45	62	1.25	833	842	982	851	882	150	84	96	96
Karmont	6700	19.6	59.1	14.9	14.2	69.0	.44	64	1.25	824	871	853	849	871	152	85	90	90
Average		16.8	59.2	15.3	14.4	70.6	.45	62	1.25	885	888		894	909	150	83	93	93
Summary 4 years-1941 to 1944																		
Four																		
Hard	1941	25.8	55.8	17.2	16.3	58.5	.52	66	2.0	893	987	981	951		149	36	81	81
Red	1942	23.9	56.8	13.5	17.3	71.0	.51	66	2.0	758	898	1081	966		148	85	76	76
Spring	1943	37.2	58.7	15.6	14.8	66.4	.59	64	2.0	771	834	865	841		150	83	79	79
Wheats	1944	17.3	60.6	15.9	15.0	70.6	.51	63	1.3	897	889				150	88	93	93
Aver.		26.1	58.0	16.8	15.9	66.6	.53	65	1.3	807	929	954	919		149	86	82	82
Br. Red.																		
Four																		
Hard	1941	35.7	56.9	17.0	16.4	68.8	.42	63	2.1	718	842	942	991		149	78	78	78
Red	1942	40.7	56.8	15.7	14.7	67.5	.52	63	2.1	729	814	869	835		149	73	76	76
Winter	1943	41.5	59.9	14.8	13.9	66.7	.52	61	2.0	579	728	769	769		148	74	77	77
Wheats	1944	16.8	59.2	15.3	14.4	70.6	.45	62	1.3	885	888				150	83	93	93
Aver.		33.7	58.2	15.7	14.9	68.4	.48	62	1.9	709	817	867	865		149	77	81	81

Table 10--Milling, baking and chemical results on ten composite commercial samples of hard red spring wheat obtained at Minneapolis, Minn., Great Falls, Mont., and Spokane, Wash., representing the 1924 crop.

Location where obtained	Samples com- posited from car lots	U.S. Grade	Test weight	Protein		Flour Yield Ash	Water absor- tion average time	Baking Methods and Loaf Volume							Average			
				Wheat Flour				Milligrams of Bromate				Wt. of Loaf	Crumb Color	Grain texture Score				
				Lbs.	Pct.			Pct.	Pct.	1	2				3	4	best	Cc.
Spokane, Wash.	73	1 D.M.S.	59.3	14.3	13.8	73.0	.53	64	2.0	824	824	862	853	846	862	149	95	90
Great Falls, Mont.	597	1 Hvy. D.M.S.	61.2	13.0	12.8	71.5	.50	66	2.0	801	827	795		808	827	150	93	92
Do.	325	1 D.M.S.	57.1	14.3	13.4	71.3	.57	66	2.5	809	875	892	892	886	892	149	90	88
Do.	139	1 Hvy. D.M.S.	61.8	11.9	11.1	72.6	.49	65	2.0	741	746	701		729	746	150	88	85
Minneapolis, Minn.	59	1 Hvy. D.M.S.	61.2	12.4	11.8	72.4	.51	64	2.0	729	766	755	747	756	766	149	92	87
Do.	282	1 D.M.S.	59.8	12.6	12.1	72.8	.52	65	2.5	781	803	798	783	795	803	150	88	87
Do.	334	2 D.M.S.	56.1	13.1	12.3	72.1	.53	63	2.	781	806	812	789	802	812	150	85	87
Do.	173	3 D.M.S.	57.5	13.3	12.6	71.6	.52	63	2.	830	865	809	818	838	865	149	88	88
Do.	117	1 N.S.	56.6	12.1	11.6	73.3	.49	64	2.	750	807	792	767	789	807	150	87	85
Do.	126	2 N.S.	56.3	12.8	12.2	73.2	.52	64	2.5	830	839	845		838	845	149	90	90
Average			59.6	13.0	12.4	72.4	.52	65	2.5	788	815			809	823	150	90	88
Range			4.4	2.4	2.7	2.0	.08	.20	.5	101	174			157	146	1	10	7

Correlation coefficients (r) for loaf volume and flour protein content of 14 varieties and strains and also the commercial samples have been calculated and are presented in Table 11. Also indicated in this table is the slope of the regression line or the cubic centimeter change in loaf volume for each 1.0 percent of protein (b_1) the average protein content of the flour and the loaf volumes of the bread, and the loaf volumes adjusted to a 13.0 percent protein basis by the means of the regression equation. The plotted regression lines for each variety and the commercial samples are shown in Figure 1 to 4.

The figures show the individual points and are evidence that the relation between loaf volume and protein content is generally linear. With a few exceptions the points fall on or very close to the calculated regression lines. The majority of the correlation coefficients for loaf volume and flour protein content were high. The varieties having the highest coefficients were Regent, Ceres, and Henry. The wheat having low correlation coefficients were N.N.1753, N.N.1764, Newthatch and the commercial samples. It should be noted that the number of samples of each variety is rather small for a study of this kind. This fact should be considered in evaluating the results.

One of the important results of this study and of interest are the differences in the level and in the slope of the regression lines for the different varieties. The regression line for N.N.1750 is lowest as contrasted with the lines for Rival, Henry, Thatcher, and Pilot which are definitely high. The relative position of the regression lines appears to be a rather satisfactory measure of the relative protein quality of these varieties. From these lines, the varieties and strains can be compared with each other by the means of the loaf volume taken at a medium protein level (13.0 percent) as calculated from the regression lines. The loaf volume for each variety is the point at which the regression line crossed the 13.0 percent protein value in the graphs in Figures 1 to 4. These loaf volumes are shown in the last column of Table 11. By this method the varieties are grouped for the 1944 season with respect to differences in protein quality in relation to Rival as follows:

- | | |
|---|-------------------------------------------------------------------------------|
| 1 | Rival |
| 2 | Thatcher, Regent, N.N.1753, Cadet, Pilot, Marquis, Henry, Commercial samples. |
| 3 | Mida, Ceres, N.N.1764, Newthatch, N.N.1756. |
| 4 | N.N.1750. |

The low protein level of the 1944 samples and the wet harvesting period with the tendency of Rival wheat to sprout may be important factors in these results. Averages of several seasons results may reveal the importance of these associations.

Protein strength or protein quality is by no means the only measure of the suitability of a wheat variety or strain for bread baking purposes. It is however, only one of the many measures of the properties of a flour, but probably considered the most important in relation to bread baking. Other flour properties considered important are milling time, water absorption, oxidation and the bread grain, texture and crumb color. These quality factors are given in the other tables.

Table 11--Summary of protein content-loaf volume data.

Variety	No. of samples	b_1 ^{1/}	r ^{2/}	Protein of flour (pct.)	Average Loaf volume (C.C.)	Loaf volume at 13.0 percent protein content ^{3/}
Rival	10	65.3	.9368	12.36	837.9	908
Thatcher	18	65.4	.9406	12.83	840.0	854
Regent	10	59.4	.9744	13.19	832.4	870
Pilot:Mida NN1750	8	59.1	.9046	12.41	750.3	786
Mida	14	56.6	.9545	12.51	819.0	847
Regent:Pilot NN1753	5	54.3	.7305	13.40	894.4	873
Ceres	6	54.0	.9674	13.00	817.6	818
Cadet	14	52.4	.9038	13.11	822.2	875
Pilot	14	52.4	.9332	11.90	831.8	889
Merit:Pilot NN1764	13	50.1	.8678	13.15	813.1	843
Newthatch	14	42.8	.8751	13.53	834.1	837
Marquis	7	47.7	.9505	12.34	831.4	861
Henry	6	47.3	.9698	11.55	721.3	898
Commercial samples	10	47.4	.8520	12.37	822.5	851
Pilot:Mida NN1756	7	45.3	.9370	12.35	803.0	832

- ^{1/} Slope of regression line or change in loaf volume for each one percent of protein.
^{2/} Loaf volume vs flour protein content
^{3/} Calculated from regression equation.

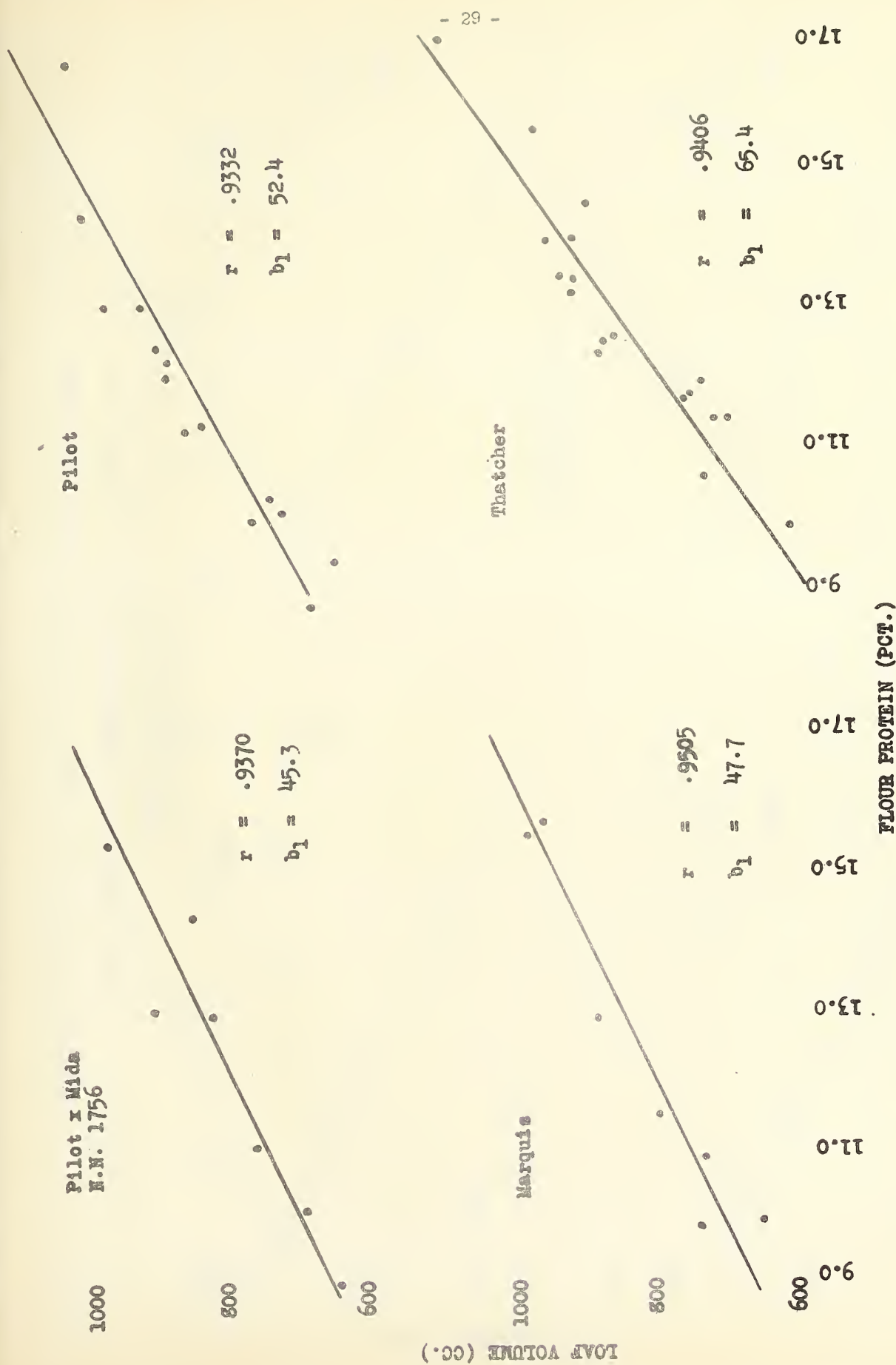


Figure 1. - Scatter diagrams and regression lines for flour protein and loaf volume for a number of the hard red spring varieties, 1944 crop.

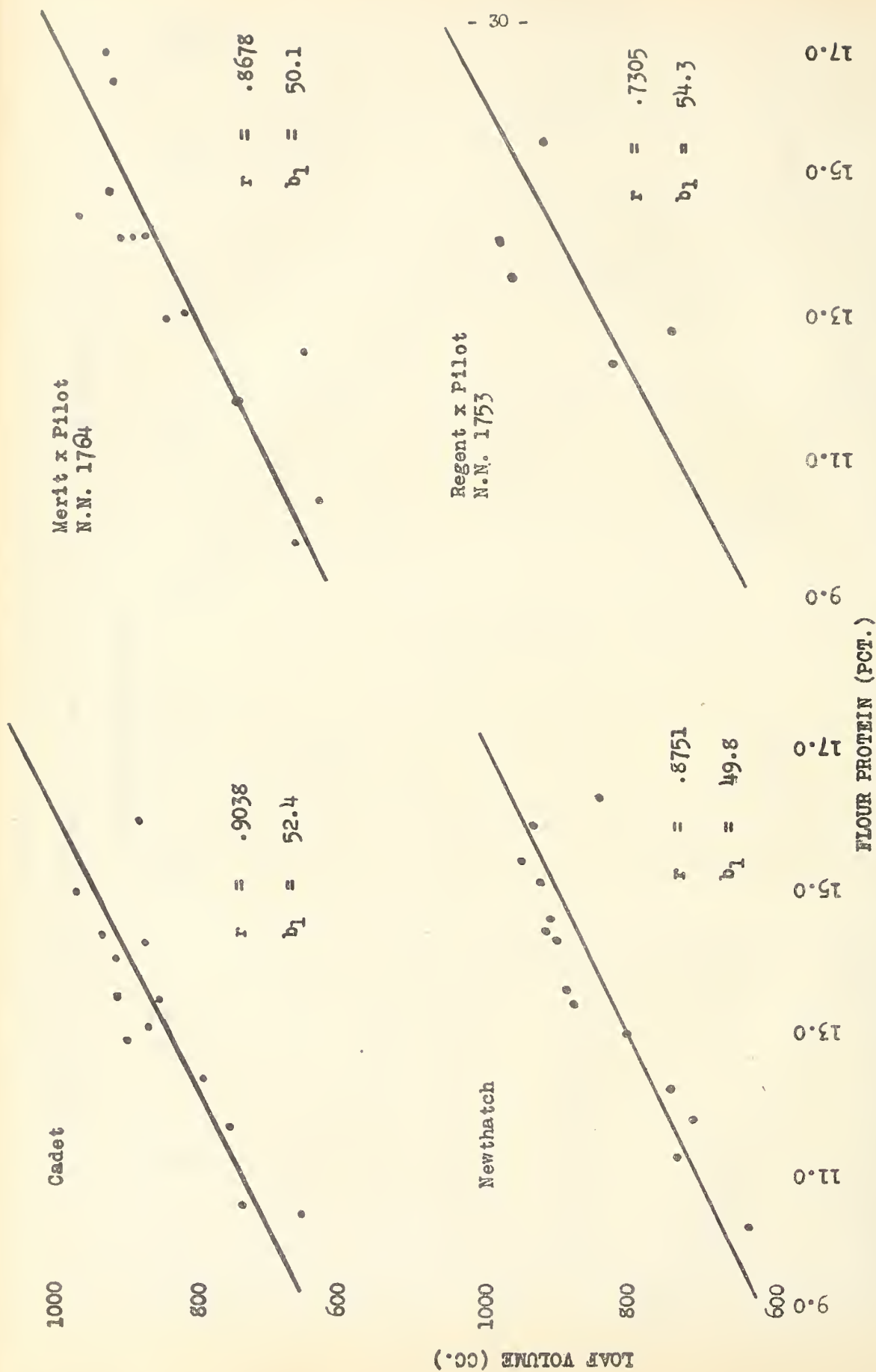


Figure 2. - Scatter diagrams and regression lines for flour protein and loaf volume for a number of the hard red spring varieties, 1944 crop.

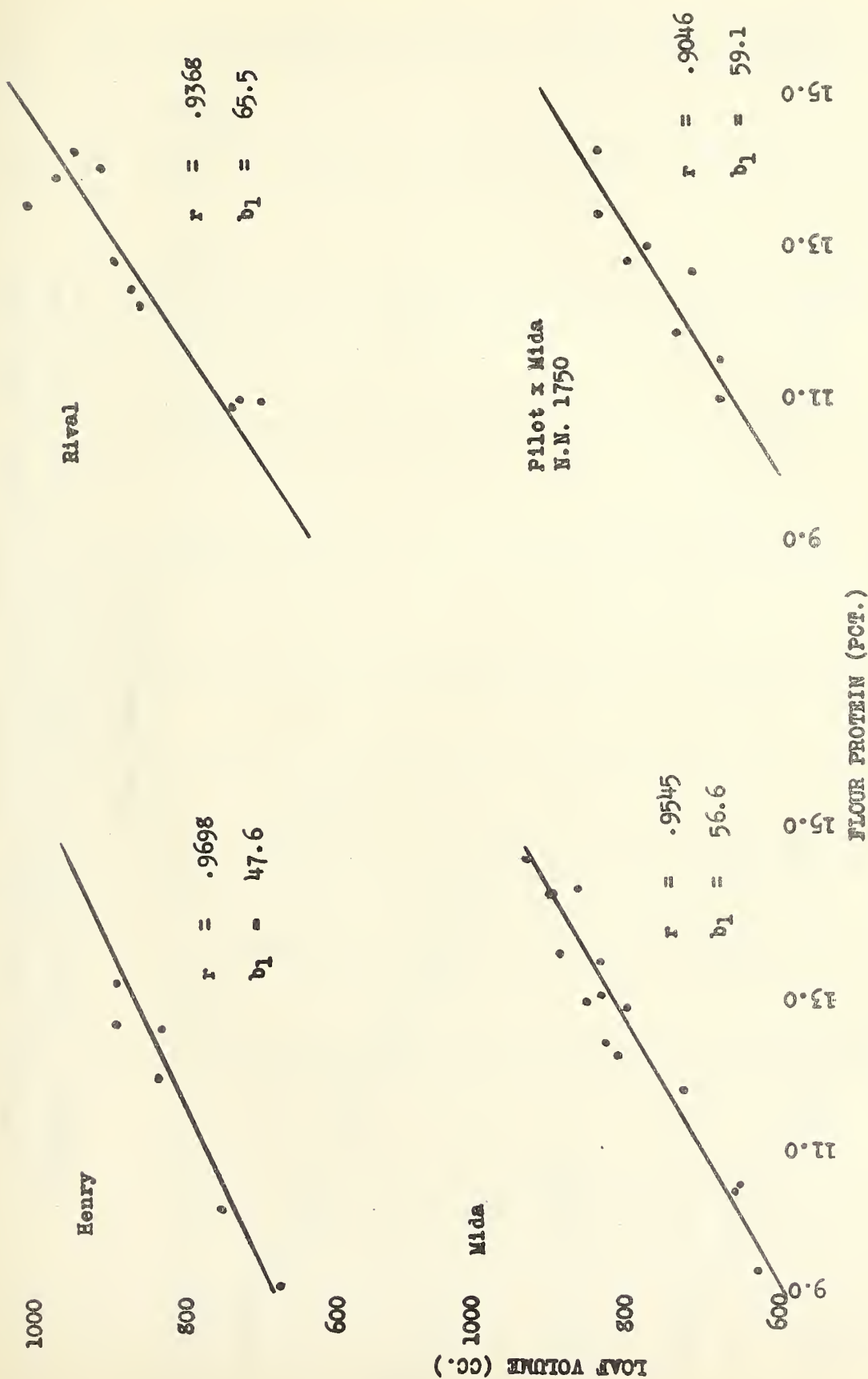
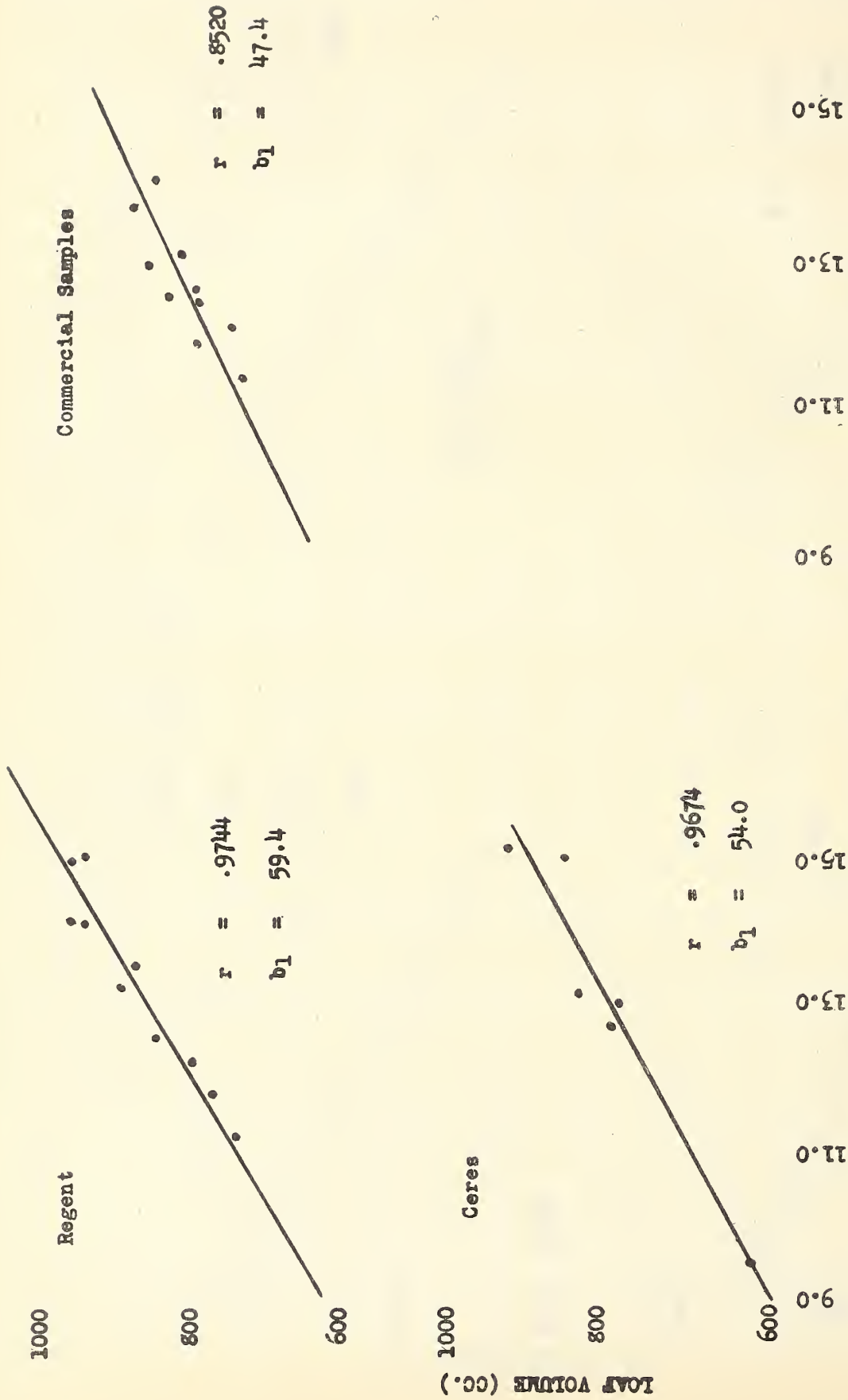


Figure 3. - Scatter diagrams and regression lines for flour protein and loaf volume for a number of the hard red spring varieties, 1944 crop.



FLOUR PROTEIN (PCF.)

Figure 4. - Scatter diagrams and regression lines for flour protein and loaf volume for a number of the hard red spring varieties, 1944 crop.

Table 13--Average of the milling, baking and chemical properties of 14 flours, the average of comparable samples of Thatcher, and of each variety in percentage of Thatcher, with varieties arranged in order of percentage for optimum loaf volume in 1944.

Variety or Cross	No. of Samples	Test weight	Protein wheat	Yield of flour	Ash in flour	Absorption	Baking Methods and Loaf Volume			Crumb Color	Grain texture
							No. 6 Co.	Average Co.	Optimum Co.		
		Lbs.	Pct.	Pct.	Pct.	Pct.				Score	Score
Regent	10	58.6	13.7	72.9	.51	63	844	860	882	87	88
Thatcher	10	59.0	13.1	73.3	.52	64	790	811	833	85	86
Percentage of Thatcher		99.3	104.6	99.5	98.1	98.4	105.3	106.0	105.9	102.4	102.3
N. 1753	5	60.1	13.5	70.1	.47	67	675	878	894	84	88
Thatcher	5	59.1	14.1	72.5	.49	65	625	824	845	86	89
Percentage of Thatcher		101.7	102.6	97.1	95.9	103.1	103.3	106.6	105.8	98.0	99.0
Rival	10	59.2	13.2	74.7	.53	65	635	844	868	89	88
Thatcher	10	59.0	13.1	73.3	.52	64	755	811	833	85	86
Percentage of Thatcher		100.3	100.8	101.9	101.9	101.6	106.8	1104.1	104.2	104.7	102.3
Cadet	14	58.6	13.7	72.4	.51	67	645	863	885	90	90
Thatcher	14	58.8	13.5	73.0	.51	64	620	829	850	85	86
Percentage of Thatcher		99.7	101.5	99.2	100.0	104.7	103.0	104.1	104.1	105.9	104.7
Newhatch	14	58.4	14.1	73.9	.52	64	645	842	864	84	87
Thatcher	14	58.8	13.5	73.0	.51	64	620	829	850	85	86
Percentage of Thatcher		99.3	104.4	101.2	102.0	100.0	105.4	101.6	101.6	98.8	101.2
N. 1764	13	58.6	13.3	71.7	.52	68	651	834	853	88	88
Thatcher	13	58.7	13.5	73.0	.50	64	615	823	846	86	88
Percentage of Thatcher		99.8	101.3	98.2	104.0	106.3	111.5	101.3	100.8	102.3	100.0
Marquis	9	58.1	13.2	70.4	.50	63	615	808	830	82	87
Thatcher	9	58.8	13.3	72.4	.50	65	622	820	838	84	87
Percentage of Thatcher		98.9	95.7	97.2	100.0	96.9	99.1	98.5	99.0	97.6	100.0
Pilot	16	59.0	13.1	71.6	.45	63	611	804	827	88	88
Thatcher	16	59.0	13.2	73.0	.50	64	620	826	846	85	86
Percentage of Thatcher		100.0	97.0	98.1	90.0	98.4	93.9	97.3	97.8	103.5	102.3
Henry	6	59.0	12.5	75.3	.48	63	730	809	832	79	85
Thatcher	6	58.2	13.3	73.5	.53	64	617	829	851	88	88
Percentage of Thatcher		101.4	93.6	102.4	90.6	98.4	96.7	97.6	97.8	89.8	96.6
Mida	14	60.5	13.3	74.5	.49	64	610	798	819	90	87
Thatcher	14	58.8	13.5	73.0	.51	64	620	829	850	85	86
Percentage of Thatcher		102.9	96.5	102.1	96.1	100.0	93.6	96.4	96.4	105.9	101.2
Ceres	8	59.9	13.7	72.4	.47	65	613	804	818	85	88
Thatcher	8	59.6	13.0	72.8	.47	65	641	844	860	84	87
Percentage of Thatcher		100.5	97.9	99.5	100.0	100.0	96.6	95.3	95.1	101.2	101.1
N. 1756	7	60.9	13.2	72.5	.43	63	793	784	805	89	89
Thatcher	7	58.5	13.0	72.6	.50	64	726	832	848	83	87
Percentage of Thatcher		104.1	94.5	99.9	86.0	98.4	93.0	94.2	94.9	107.2	102.3
N. 1750	8	61.9	13.5	72.8	.49	65	737	738	751	90	86
Thatcher	8	59.0	13.7	72.5	.51	64	608	808	826	85	88
Percentage of Thatcher		101.9	93.5	100.4	96.1	101.6	91.6	91.3	90.9	105.9	97.7

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Table 13--Annual and total number of samples comparable with Thatcher and weighted average milling, baking and chemical properties expressed in percentage of Thatcher for the 7 years, 1938 to 1944.

Variety State or Nursery No.	Crop year and number of samples							Total
	1938	1939	1940	1941	1942	1943	1944	
Thatcher	11	12	14	16	18	20	18	109
Pilot	8	11	14	13	14	14	16	90
Rival	8	9	9	13	11	12	10	72
Cadet	--	--	2	10	16	13	14	55
Regent	2	4	7	10	9	12	10	54
Mida	--	2	9	10	7	8	14	50
Marquis	2	4	8	9	9	8	9	49
Newthatch	--	--	2	9	12	12	14	47
Ceres	4	3	6	7	6	7	8	41
Henry	--	--	--	--	3	6	6	15
N. No. 1764	--	--	--	--	--	2	13	15
N. No. 1756	--	--	--	--	--	4	7	11
N. No. 1750	--	--	--	--	--	3	8	11
N. No. 1753	--	--	--	--	--	3	5	8

Variety State or Nursery No.	Test weight per bushel							Range
	1938	1939	1940	1941	1942	1943	1944	
N. No. 1750	--	--	--	--	--	106.6	104.9	105.4
Mida	--	104.8	105.6	107.9	106.5	104.1	102.9	105.1
N. No. 1756	--	--	--	--	--	105.5	104.1	104.6
Henry	--	--	--	--	102.4	103.0	101.4	102.2
N. No. 1753	--	--	--	--	--	102.3	101.7	102.0
Rival	105.1	100.7	100.2	103.6	102.6	101.0	100.3	101.9
Ceres	102.1	102.5	98.4	103.2	101.2	100.3	101.5	101.1
Pilot	100.9	100.0	100.5	102.3	101.6	100.2	100.0	100.7
Regent	101.5	97.0	98.6	102.6	102.3	100.0	99.3	100.6
N. No. 1764	--	--	--	--	--	102.0	99.8	100.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Newthatch	--	--	99.8	101.3	101.0	98.5	99.3	99.9
Cadet	--	--	98.8	100.4	101.0	98.5	99.7	99.9
Marquis	100.0	100.7	96.1	99.5	102.3	100.0	98.9	99.7

Variety State or Nursery No.	Crude protein content of the wheat							Average
	1938	1939	1940	1941	1942	1943	1944	
Newthatch	--	--	102.4	108.9	107.8	106.1	104.4	106.3
Regent	106.0	103.1	102.5	106.8	106.1	104.7	104.6	104.9
N. No. 1753	--	--	--	--	--	104.6	102.8	103.5
Cadet	--	--	100.0	104.8	104.9	103.6	101.5	103.5
N. No. 1764	--	--	--	--	--	101.0	101.5	101.6
Mida	--	97.6	95.6	102.0	102.1	107.6	98.5	100.6
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Rival	100.0	94.2	97.5	100.7	100.7	101.3	100.8	99.5
N. No. 1750	--	--	--	--	--	100.6	98.5	99.1
Pilot	102.0	94.2	100.0	100.7	98.6	99.3	97.0	98.7
Ceres	98.6	95.7	97.4	97.5	98.1	101.3	97.9	98.3
Marquis	100.0	95.1	93.2	96.9	96.0	94.4	95.7	95.5
N. No. 1756	--	--	--	--	--	97.3	94.3	95.4
Henry	--	--	--	--	97.8	95.3	92.6	94.7

Table 13 --Continued

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Variety State or Nursery No.	Yield of flour							
	1938	1939	1940	1941	1942	1943	1944	Average
Henry	--	--	--	--	102.8	102.3	102.4	102.5
Rival	105.5	102.7	99.4	103.1	101.2	103.4	101.9	102.4
Mida	--	100.7	102.3	102.5	102.7	101.9	102.1	102.2
Newthatch	--	--	102.5	100.9	101.7	101.4	101.2	101.4
Regent	100.9	98.4	100.0	100.9	99.7	102.3	99.5	100.5
N. No. 1750	--	--	--	--	--	99.7	100.4	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cadet	--	--	99.3	99.6	100.0	100.3	99.2	99.9
N. No. 1756	--	--	--	--	--	99.3	99.9	99.8
Ceres	102.4	100.3	95.3	100.7	99.0	100.3	99.5	99.6
Pilot	98.5	99.3	98.2	99.4	99.9	99.7	98.1	99.0
N. No. 1764	--	--	--	--	--	96.9	98.2	98.0
N. No. 1753	--	--	--	--	--	97.3	97.1	97.1
Marquis	100.0	99.3	94.2	92.9	98.7	99.3	97.2	96.7

Variety State or Nursery No.	Ash in flour							
	1938	1939	1940	1941	1942	1943	1944	Average
Cadet	--	--	123.9	113.5	105.7	107.1	100.0	106.6
Newthatch	--	--	126.1	111.5	101.9	107.1	102.0	105.7
Marquis	100.0	101.3	107.5	109.4	103.8	110.2	100.0	105.5
N. No. 1764	--	--	--	--	--	109.2	114.0	104.7
Rival	96.1	104.0	107.5	105.8	98.1	108.1	101.9	103.5
Regent	104.0	111.3	115.4	103.8	92.3	100.0	98.1	102.0
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	98.0	103.3	98.1	103.8	96.2	100.0	100.0	99.2
N. No. 1753	--	--	--	--	--	103.3	95.9	98.8
Mida	--	95.3	100.0	105.9	92.3	94.7	96.1	97.6
Pilot	100.0	96.0	100.0	101.9	96.2	98.1	90.0	97.4
N. No. 1750	--	--	--	--	--	96.3	96.1	96.2
N. No. 1756	--	--	--	--	--	100.0	86.0	91.1
Henry	--	--	--	--	87.7	93.1	90.6	91.0

Variety State or Nursery No.	Water absorption of flour							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1764	--	--	--	--	--	100.2	106.3	106.7
Cadet	--	--	109.2	104.8	106.7	104.2	104.7	105.4
N. No. 1753	--	--	--	--	--	105.4	103.1	104.0
Rival	103.9	100.5	102.2	103.2	105.0	102.7	101.6	102.8
N. No. 1750	--	--	--	--	--	101.7	101.6	101.6
Newthatch	--	--	104.6	101.1	102.1	100.3	100.0	101.1
Ceres	102.9	97.7	101.5	103.2	101.6	100.3	100.0	101.1
Regent	100.7	99.1	100.5	101.6	101.6	99.4	98.4	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mida	--	97.3	99.8	98.4	101.6	100.3	100.0	99.9
Pilot	97.8	98.9	100.5	100.0	100.0	98.5	98.4	99.2
Henry	--	--	--	--	100.0	99.3	98.4	99.1
N. No. 1756	--	--	--	--	--	98.4	98.4	98.4
Marquis	100.0	94.3	97.1	100.0	100.0	97.1	96.9	98.1

Table 13--Continued

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Variety State or Nursery No.	Loaf Volume, Method No. 6							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1753	--	--	--	--	--	107.7	106.8	107.1
Newthatch	--	--	97.4	103.7	103.3	99.4	103.4	102.1
Regent	109.8	100.1	99.9	105.0	103.6	95.0	105.6	101.8
N. No. 1764	--	--	--	--	--	96.1	101.9	101.1
Cadet	--	--	97.9	102.2	100.5	97.1	103.0	100.5
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Pilot	97.3	95.3	98.0	99.6	101.1	100.6	98.9	99.0
Rival	95.4	94.2	90.3	97.1	101.7	99.6	106.8	98.2
Ceres	95.6	91.9	89.9	99.1	100.2	102.6	96.6	97.2
Marquis	94.2	90.9	90.0	99.3	95.3	96.0	99.1	95.6
Mida	--	87.7	88.8	91.5	98.4	95.6	98.8	95.0
Henry	--	--	--	--	99.2	96.3	96.7	94.8
N. No. 1756	--	--	--	--	--	90.4	96.0	94.0
N. No. 1750	--	--	--	--	--	86.9	91.6	90.3

Variety State or Nursery No.	Loaf Volume, Average							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1753	--	--	--	--	--	103.7	106.6	105.5
N. No. 1764	--	--	--	--	--	94.3	101.3	101.4
Newthatch	--	--	97.8	102.2	102.6	99.3	101.6	101.3
Regent	101.6	98.6	99.8	102.8	101.9	94.4	106.0	100.6
Pilot	102.7	97.3	99.0	100.1	103.0	103.4	97.3	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cadet	--	--	97.7	100.2	98.4	94.9	104.1	99.3
Ceres	98.7	97.2	95.4	98.1	101.8	103.9	95.3	98.7
Rival	99.0	94.0	91.0	95.9	101.0	100.0	104.1	98.0
Marquis	96.5	93.6	91.9	98.1	95.6	99.3	98.5	96.3
Mida	--	91.5	89.2	91.9	98.6	96.8	96.4	94.7
Henry	--	--	--	--	96.5	89.5	97.6	94.1
N. No. 1756	--	--	--	--	--	92.5	94.2	93.6
N. No. 1750	--	--	--	--	--	87.7	91.3	90.3

Variety State or Nursery No.	Loaf Volume, Optimum							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1753	--	--	--	--	--	107.0	105.9	106.3
Regent	106.6	99.7	100.5	104.9	103.1	95.3	105.9	101.7
Newthatch	--	--	97.4	103.4	103.0	99.9	101.6	101.6
Cadet	--	--	97.9	101.5	100.0	97.2	104.1	100.6
Pilot	99.3	96.0	98.5	100.0	101.4	100.6	97.8	100.3
N. No. 1764	--	--	--	--	--	96.1	100.8	100.2
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Rival	97.3	93.9	92.1	96.6	101.2	99.3	104.2	98.1
Ceres	97.3	91.9	90.2	99.4	100.8	102.6	95.1	97.2
Marquis	94.3	90.9	91.9	98.8	95.7	96.2	99.0	95.9
Henry	--	--	--	--	98.9	90.8	97.8	95.2
Mida	--	88.4	89.0	91.4	98.2	98.6	96.4	94.4
N. No. 1756	--	--	--	--	--	90.4	94.9	93.3
N. No. 1750	--	--	--	--	--	86.9	90.9	89.8

Variety State or Nursery No.	Crumb Color, Average							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1756	--	--	--	--	--	103.6	107.2	107.7
N. No. 1750	--	--	--	--	--	111.3	105.9	107.4
Mida	--	103.8	103.6	111.1	107.0	103.4	105.9	107.2
Cadet	--	--	101.1	111.1	105.8	100.0	105.9	105.2
Pilot	109.5	101.7	100.1	103.6	105.8	103.0	103.5	104.1
Rival	108.9	98.2	96.4	103.6	105.8	104.8	104.7	103.3
N. No. 1764	--	--	--	--	--	103.8	102.3	103.2
Marquis	92.6	104.2	100.0	100.0	104.6	106.2	97.6	101.4
N. No. 1753	--	--	--	--	--	103.2	98.0	101.1
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Newthatch	--	--	94.3	107.6	100.0	96.4	98.8	99.6
Regent	97.5	95.7	97.7	103.7	103.5	92.3	102.4	99.4
Ceres	95.3	100.0	95.2	100.0	100.0	93.3	101.2	98.9
Henry	--	--	--	--	90.0	91.5	89.8	90.5

Variety State or Nursery No.	Grain-texture, Average							
	1938	1939	1940	1941	1942	1943	1944	Average
N. No. 1756	--	--	--	--	--	102.8	102.3	103.2
Pilot	104.6	99.9	97.0	101.2	102.3	103.6	102.3	101.6
Cadet	--	--	94.4	102.3	101.1	97.6	104.7	101.2
N. No. 1764	--	--	--	--	--	103.8	100.0	101.2
Mida	--	103.4	97.8	101.1	101.1	104.7	101.2	100.6
Newthatch	--	--	96.6	100.0	101.1	100.0	101.2	100.5
Rival	99.3	99.0	94.3	101.2	101.1	103.3	102.3	100.4
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Marquis	91.1	100.3	98.9	100.0	100.0	102.5	100.0	99.9
N. No. 1753	--	--	--	--	--	101.3	99.0	99.8
Ceres	93.7	103.7	95.3	101.2	98.8	103.7	101.1	99.8
N. No. 1750	--	--	--	--	--	104.3	97.7	99.7
Regent	95.9	93.5	93.3	98.9	100.0	93.4	102.3	97.9
Henry	--	--	--	--	98.3	96.4	96.6	97.0

Variety State or Nursery No.	Summary of seven properties							
	Test weight	Crude protein	Flour yield	Absorption	Opt. Volume	Crumb color	Grain-texture	Average 7 properties
Cadet	99.9	103.5	99.9	105.4	100.6	103.2	101.2	102.2
N. No. 1753	101.9	103.5	97.1	104.0	106.3	101.1	99.8	102.0
N. No. 1764	100.1	101.6	98.0	106.7	100.2	103.2	101.2	101.6
Newthatch	99.9	103.3	101.4	101.1	101.6	99.3	100.5	101.5
Mida	105.1	100.6	102.2	99.9	94.4	107.2	100.6	101.4
Rival	101.9	95.5	102.4	102.8	98.1	103.3	100.4	101.2
Regent	100.6	104.9	100.5	100.2	101.7	99.4	97.9	100.7
Pilot	100.7	98.7	99.0	99.2	100.3	104.1	101.6	100.5
N. No. 1750	105.4	99.1	100.2	101.6	89.8	107.4	99.7	100.5
N. No. 1756	104.6	95.4	98.8	98.4	93.3	107.7	103.2	100.3
Thatcher	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Ceres	101.1	98.3	99.6	101.1	97.2	98.9	99.8	99.4
Marquis	99.7	95.5	96.7	98.1	95.9	101.4	99.9	98.2
Henry	102.2	94.6	102.5	99.1	95.2	90.5	97.0	97.3

COMPARABLE SAMPLES WITH THATCHER: 1944

In table 11, the properties of the 1944 samples of 13 varieties or strains of hard red spring wheat are compared with those of Thatcher grown in the same tests. The varieties are arranged in order of percentage for the optimum loaf volume. The results appear to be in general agreement with the 7-year averages.

COMPARABLE SAMPLES 1938 to 1944

Table 12 gives the 7-year averages of the milling, baking, and chemical properties of 14 varieties and strains, together with the averages of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. From 8 to 90 comparisons were made for these wheats. The more important quality comparisons shown in the summary table 12 will be discussed in relation to Thatcher as 100 percent.

Thatcher

Thatcher has been a uniform variety in the plot experiments since 1932. It was distributed for commercial growing in 1934. It is resistant to stem rust, is early, has short, strong straw and yields well. Its commercial acreage increased rapidly until it became the most widely grown variety in 1938. It probably reached its peak in 1941 when it was grown on about 6 million acres in the United States and 9 or 10 million acres in Canada. Being susceptible to leaf rust, it was injured severely in 1938, 1939, and again in 1941 and its acreage has since decreased giving way to Rival and Pilot in the leaf-rust-affected sections. Thatcher replaced Marquis as a standard of comparison in 1939 and as it is still the most widely grown hard red spring variety it is here used as the standard of comparison for the different milling and baking properties.

These tests show Thatcher to average about medium in test weight being exceeded by a number of the commercially acceptable varieties. It has shown excellent milling qualities producing a high percentage of flour and somewhat better than would be expected from its test weight. The protein content is medium to high and the flour ash about average as compared with the flour ash from a number of other commercially grown varieties. The quality of the protein is strong. Thatcher has excellent baking qualities in experimental baking tests and is preferred by the grain trade for a strong type bakers' flour. It ranks high in loaf volume of bread, has good grain-texture, satisfactory but only medium crumb color and a reasonably high water absorption. The 1944 correlation coefficient for flour protein-loaf volume was high ($r=.9406$) and the slope of the regression line ($b_1=65.4$ cc) second highest exceeded only by Rival in this respect. In table 12 are summarized the data from 2 to 7 years tests, giving the relative rank of 14 wheats in percentage of Thatcher, for the principal milling and baking properties.

Pilot

Pilot has been a uniform variety in plot experiments since 1936 and commercially grown since 1939. It has shown excellent milling and baking qualities in experimental baking tests and is approved by the grain trade for a strong type flour. Pilot is resistant to both stem and leaf rust, to mildew, bunt and some of the rootrots. It has been the highest yielding of the uniform varieties during the past 7 years, ranking first in five of the years. It has also ranked first for quality during the 7-year period in the Eastern and Western composites of the uniform varieties for the region exceeding Thatcher in loaf volume (table 2). The weighted average of 90 comparable samples for 7 years shows Pilot exceeds Thatcher with respect to test weight, average and optimum loaf volume of bread and for crumb color and grain-texture. Pilot has been uniformly low in flour ash content and exceeded many of the uniform varieties in this respect. It has a short dough mixing time. It averages slightly lower than Thatcher for the other properties. Loaf volumes for the 1944 samples were unusually low due in part to the low protein season and the high yields. In supplemental baking tests Pilot does not usually respond to increasing amounts of bromate and is easily injured by long fermentation periods. The dough properties of Pilot are elastic and pliable as contrasted with some varieties which produce bucky doughs, considered objectionable. The correlation coefficient for flour protein-loaf volume was high ($r=.9332$) and the slope of the regression line ($b_1=52.4$) exceeded Newthatch and Marquis.

Rival was made a uniform variety in 1938 and together with Pilot was distributed for commercial growing in 1939. They have increased to nearly 3 million acres, with Rival exceeding Pilot about 2 to 1. Rival has shown good milling and baking qualities in experimental baking tests and is considered satisfactory by the grain trade. Both Pilot and Rival are awned wheats and do not have as strong straw as desired for the heavier soils in the eastern section. Among the uniform varieties Rival has yielded less than Pilot but more than Thatcher during the past 7 years, for the region, and has yielded much better in the eastern than in the western sections. The weighted average of 72 comparable samples for 7 years show Rival to exceed Thatcher with respect to test weight, flour yield, water absorption, crumb color, and grain texture.

The 1944 samples of Rival are consistently higher than usual in loaf volumes. It has been outstanding as to yield of flour ranking better than most of the varieties and strains grown over a period of years. Of the 14 wheats shown in table 12, it ranks 8th in optimum loaf volume and 8th for the average of 7 of principal properties. The correlation coefficient for flour protein-loaf volume was high ($r=.9368$) and the slope of the regression line ($b_1=65.5$) exceeding all the 14 wheats to which it was compared.

Cadet

Cadet has been a uniform variety for the region for the 3 years 1943 to 1944. It is the result of a Herit x Thatcher cross and was increased in 1944 and distributed for commercial growing in 1945. Cadet is a midseason, awnleted wheat resistant to both stem and leaf rusts. It has been a high yielding wheat for the region but appears best adapted to the northern part. During a 5-year period 55 comparable milling and baking tests show it to exceed Thatcher with respect to crude protein content of wheat, water absorption, loaf volume for the No. 6 and optimum, crumb color and grain and texture. It is approximately equal to Thatcher in test weight and flour yield, has a higher ash in the flour and greater water absorption. Supplemental baking tests show that it responds sharply to increasing amounts of bromate and generally has greater tolerance to longer periods of mixing and fermentation than most varieties. It has ranked high by the malt-phosphate-bromate cake used by the North Dakota and Canadian laboratories. Commercial milling and baking tests for the last 3 years rank it high in quality. It ranks 3rd in crude protein of wheat, 2nd in water absorption, 5th in loaf volume by the No. 6 method, 4th in loaf volume by the optimum bake, and crumb color, 3rd in grain-texture and 1st., for the average of 7 principal properties in comparison with 14 wheats. The 1944 correlation coefficient for flour protein-loaf volume was medium high ($r=.9038$) and the slope of the regression line also in medium ($b_1=52.4$)

Regent

Regent has been a uniform variety since 1942. It was developed and distributed by the Canadian Department of Agriculture in 1939 and has been grown commercially in the United States since 1940. It is recommended for growing on the heavier soils of the Red River Valley of Minnesota and North Dakota. In other areas, however, it has been damaged by heat and scab and has not been a high-yielding wheat. It has shown excellent milling and baking qualities in experimental tests and has been approved by the commercial grain trade. Fifty-four comparable tests with Thatcher covering 7 years show it to exceed Thatcher with respect to test weight, crude protein of wheat, flour yield, water absorption, loaf volume for the average No. 6, and optimum, but lower in other properties. It is higher in ash of flour than Thatcher. Regent has been particularly high in protein exceeding many of the wheats with which it has been comparably grown. The better loaf volume obtained from Regent indicated that the quality of the protein is also good. It has about the same dough mixing time as Thatcher. Regent averages 7th in the summary of 7 principal properties. It had one of the highest correlation coefficients for flour-protein-loaf volume ($r=.9744$) and was among the better wheats with respect to the slope of the regression line ($b_1=59.4$).

N. N. 1750

N. N. 1750 is Pilot x Mida (C. 19412316) and is the 5th highest yielding wheat in the Uniform Regional Nursery for 2 years. It has been advanced to plot experiments at a large number of stations because of good yields, strong straw and unusually heavy test weight of grain. It also has good resistance to the rusts and smuts and is the most attractive wheat in both the field and bin. In 2 years comparable tests of 11 samples with Thatcher, N. N. 1750 exceeds Thatcher in test weight (ranking 1st of 14 wheats compared) yield of flour, water absorption and crumb color of bread. It has a lower flour ash than Thatcher. It averages lower than Thatcher for the other properties ranking lowest in loaf volume (all methods) of the 14 wheats. It was outstanding in test weight but only average in flour yield. The dough mixing time is longer than required for Thatcher. It ranks 9th in the summary of 7 principal properties. The correlation coefficient-flour protein-loaf volume was about average ($r=.9046$) and the slope of the line rather high ($b_1=59.1$).

Mida was first made a uniform variety for the region in 1944 when it was distributed for commercial growing by the North Dakota Agricultural Experiment Station. It has been in plot experiments at the North Dakota and Minnesota stations for 5 years and has been a high-yielding wheat. It is owned, strong-stemmed wheat, resistant to both stem and leaf rusts and to bunt. During 6 years 50 milling and baking tests show that it exceeds Thatcher with respect to test weight, crude protein of wheat, flour yield, crumb color, and grain texture and has a lower ash content of the flour. It averages lower in water absorption than Thatcher. In loaf volume Mida ranked lower than Thatcher by the No. 6 average, and optimum baking results. It ranked 12th according to the optimum bake and 11th by the No. 3 and average results, among 14 wheats. It averages high in yield of flour and crumb color (3rd of 14 wheats) and in test weight ranks 2nd. The summary of 7 principal properties shows it to rank 5th. It has commercial trade approval as satisfactory for all-purpose bakers' flour. The correlation coefficient flour protein-loaf volume was high ($r=.9545$) and the slope of the regression line medium ($b_1=56.6$).

Marquis

Marquis was a uniform variety for the region from 1929 to 1942 and is still one of the uniform varieties for the western section. It was the leading spring wheat variety of the United States from 1919 to 1934. It was long considered the standard of quality, but since 1938 has been replaced by Thatcher. Marquis is still held in high regard by the commercial trade, although in comparison with newer varieties it has not shown to advantage in experimental yield and quality tests. It is the lowest yielding of the uniform varieties. Among the 14 wheats, 49 comparable samples of Marquis and Thatcher show Marquis to be lowest in test weight, flour yield, water absorption, and also to rank lower than Thatcher with respect to crude protein, loaf volume (No. 6, average and optimum) and grain texture. It is higher than Thatcher for crumb color and also higher in ash content of flour. It ranks 10th for average loaf volume and 13th in the summary of the 7 principal properties among the 14 wheats. The correlation coefficient table for flour protein-loaf volume was high ($r=.9505$) but the slope of the regression line one of the lowest ($b_1=47.7$).

Newthatch

Newthatch is a composite of several Hope x Thatcher³ backcross strains, one of which was a uniform variety for the eastern section in 1942. In 1943 Newthatch replaced the singleline as a uniform variety for the eastern section and was made a uniform variety for the region in 1944. By using yields and milling and baking data for the single lines included in the composite, data are available for a 5-year period. The variety was distributed to seed growers by the Minnesota Agricultural Experiment Station in 1944. In the Minnesota plot experiments for 3 years, Newthatch has been outyielded only by Pilot. During a 5-year period of 47 comparable milling and baking tests, Newthatch has exceeded Thatcher with respect to crude protein of wheat flour yield, water absorption, and loaf volume (No. 6, average and optimum) and grain texture. It has a higher ash content, which is considered a disadvantage, ranking 2nd in comparison with 14 wheats. It has one distinct advantage of being highest in protein content of wheat and averages 3rd in optimum loaf volume among 14 wheats. It is about the same in test weight as Thatcher but yields slightly more flour than Thatcher on a yearly basis for the 5 years compared. The dough mixing time is similar to that of Thatcher. It ranks 4th for the average of 7 principal properties. The 1944 correlation coefficient for flour protein-loaf volume was not as high as some of the other varieties ($r=.8751$) and the slope of the regression line rather low ($b_1=49.8$).

Ceres

Ceres has been a uniform variety since the start of the coordinated regional program in 1929. It was distributed in 1926 and increased rapidly, exceeding Marquis in acreage by 1934. In the bad rust years of 1935, 1937, and 1938 it was severely damaged and was gradually replaced by Thatcher. It is still a high-yielding wheat in most of Montana and other sections where stem and leaf rusts do not occur too frequently. Ceres has consistently shown good milling and baking qualities in experimental tests and has been accepted by the commercial trade. Among the uniform varieties for the western section Ceres has been outyielded by both Thatcher and Pilot. The 1944 samples were decidedly poorer than those tested in 1943 when Ceres ranked highest for loaf volume. Among the 14 wheats summarized in table 12, 41 comparable samples of Ceres and Thatcher covering 7 years, show Ceres exceeds Thatcher with respect test weight and water absorption. It averages slightly lower than Thatcher for the other properties but ranks 7th for average loaf volume. It ranks 11th in protein content and 12th for the average of 7 of the principal properties. The correlation coefficient for flour protein-loaf volume was one of the highest ($r=.9674$) and the slope of the regression line medium high ($b_1=54.0$).

Henry has been the highest yielding wheat in the uniform regional nursery for a 3-year period and was increased and distributed by the Wisconsin Agricultural Experiment Station in 1944. It has also been a high-yielding wheat in Wisconsin experiments and has been tested at Minnesota and South Dakota stations with favorable results. During 3 years 18 milling and baking tests show that it exceeds Thatcher with respect to test weight, flour yield and has the lowest ash content of the 14 wheats. Although not the highest in test weight, it yields more flour than any of the wheats with which it was compared. The flour is soft and does not have the granular characteristics of hard wheats. It ranks lower than Thatcher in water absorption, loaf volume of bread by the No.6, average and optimum. It has a somewhat shorter dough mixing time than Thatcher. It ranks lowest in crumb color, protein content, grain-texture and the average of 7 properties of the 14 wheats compared. Henry has one of the highest correlation coefficients ($r=.8698$) between flour protein and loaf volume but ranks the slowest with respect to the slope of the regression line ($b_1=47.6$).

N.H. 1753

N.H.1753 is RegentxPilot (C.I.12317). It has been the highest quality wheat in the Uniform Regional Nursery for 2 years and has been advanced to plot experiments at several stations. It is not a high yielding wheat but is seamless and has good straw and resistance to stem and leaf rust, bunt and mildew. It also has an attractive smooth kernel of heavy test weight. In eight comparable quality tests with Thatcher in 1943 and 1944, N.H.1753 exceeds Thatcher in all properties except flour yield and grain texture and ranks first in No.6, optimum and average loaf volume among 14 wheats discussed. It has a lower flour ash than Thatcher. It handles satisfactory in the mill but the flour yield is low ranking 13th of the 14 wheats compared. Aside from the low flour yield, it is considered the most outstanding strains from a quality standpoint. The dough mixing times (only two years results) indicate that it averages slightly less than required for Thatcher. It ranks 2nd in the summary of 7 principal properties. The correlation coefficient was one of the lowest ($r=.8678$) and the slope of the line medium ($b_1=50.1$).

N.H. 1764

N.H.1764 is MeritxPilot, (C.I.12318) and is the 3rd highest yielding wheat in the Uniform Regional Nurseries for the 2-years 1943 and 1944. It has been advanced to plot experiments at a number of stations. It is an early bearded wheat with good strength of straw. It also is resistant to stem and leaf rust, bunt, mildew and scab. During the last 2 years 15 comparable milling and baking tests show it exceeds Thatcher with respect to test weight, crude protein content, water absorptions, No.6, average and optimum loaf volume crumb color and grain-texture. It has a higher ash content of flour than Thatcher. It appears to be outstanding on the basis of two years results in water absorption ranking highest among 14 varieties, and ranks high in all loaf volume tests. The dough mixing time is slightly longer than required for Thatcher. It ranks 3rd among 14 varieties for an average of 7 principal properties. It appears to be one of the outstanding strains tested during the last two years. The correlation coefficient ($r=.8678$) for flour-protein loaf volume was not as high as for many of the other comparisons as also is true for the slope of the line ($b_1=50.1$).

N.H. 1756

N.H.1756 is PilotxIde (C.I.12303) and has been the 4th highest yielding wheat in the Uniform Regional Nursery for 2 years. It has been advanced to Plot tests at a number of stations because of good yield and heavy test weight kernels. It is bearded and resistant to the rusts and smuts.

During the last 2 years 11 comparable milling and baking tests show it exceeds Thatcher in test weight, crumb color and grain-texture. It is outstanding in crumb color and grain-textures ranking highest among 14 wheats. N.H.1756 is a low flour ash strain exceeded only by Henry in this respect. It averages lower than Thatcher for the other properties and ranks 10th among 14 wheats for an average of 7 principal properties. The correlation coefficient ($r=.9370$) for flour protein-loaf volume was high but the slope of the regression line ($b_1=45.3$) one of the lowest for the 14 varieties and strains.

